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EDITORIAL

SALUTATION.

With very little ceremony we have just "basketed" a dusty calendar that did yoeman service over our desk for the past Gregorian year. Ink pocked and finger marked, it bore mute testimony to days of work, to days of rest, to tales of joy and to tales of suffering, and it had earned for itself in point of service a fate much richer than it received.

In its place there is a glossy-surfaced herald, immaculate and promising. Writ upon its surface but un-understood by man are many characters, some breathing joy and some with sorrows brimming. But there is visible clear across its every page at least one word that every one can see, and it brings to the heart the fullness of hope and the blessed privilege of waiting.

It is the most promising word in the English language. We have recently seen it on an editor's card of Christmas greeting. It is the word *Expect*. And the editor tells us this: " 'Expect,' says George Mathew Adams, "is one of the most inspiring words in the English language; it means that you believe that the things which you want will be given to you and that to which you look forward will come to pass. Some expectations are transformed to serve a better purpose; all can not be realized, but hope adds much to our life." And it is human, and beautifully human to be able to see on every calendar, in screaming letters, this wonderful pæan of hope, the word EXPECT.

It is our privilege with the close of one year and the advent of another to thank our contributors for their kind manifestations of co-operation, and we urge upon them to continue their evidence of friendship to this honored and historic journal. We also extend

our thanks to an ever-widening circle of readers for their patience with us in our humble efforts to serve them. We promise for them a continuation of our best efforts to provide readable and worth-while material—not too scientific and anhydrous, nor too light and effervescent, but rather with a view of pleasing him who "readeth for diversion" as well as him "who readeth for profit."

I. G.

REACHING OUT.

The Philadelphia College of Pharmacy and Science was founded to meet the educational needs of the apothecaries' apprentices of Philadelphia and its suburbs. As time passed, the renown of this purely local institution spread, and in due course, students came from remote regions of this country, and latterly, also from foreign countries. There have been enrolled, within recent years, students representing Canada, Cuba and other islands of the West Indies, Mexico, countries of Central and of South America, as well as Egypt, Japan and China.

After graduation, foreign students return to their homes with a friendly interest in all which is American. American text books and scientific journals, will thus be introduced into foreign lands. They will know about our products, and about our markets as a source of supply for their needs as they follow their chosen profession. Even American standards and American practice will be adapted to their own native requirements. They may be counted upon to do much in establishing and fostering friendly relations between their respective countries and our own. An institution of learning which brings students from distant countries, and trains them well in their chosen profession is, therefore, a national asset of inestimable value.

Yale is breaking ground for a new chemistry building which, including the equipment, is to cost three million dollars. And Professor Treat B. Johnson, who occupies the chair of organic chemistry, makes the statement that it is planned to make Yale a great chemical center, particularly for foreign students. But is not our College the logical center for pharmacy, and also for chemistry, and bacteriology, as far as these link up with medical practice, and

with the manufacturing of medicinal products? And should we not have similar ambitions, and set out to do in our particular field the very thing which Yale is planning to do in its field?

Think of what it would mean, in the matter of service to the country, if we could send out each year, ten or twenty times as many foreign students, trained in American science, and imbued with American ideals, as we shall send out this spring. And it can be done. No other College occupying the same field has the advantages which are ours when it comes to drawing foreign students. Our College is the oldest of its kind and is known—favorably known—wherever pharmacy is practiced. We have a good start, and have hundreds of our graduates practicing in foreign lands, where they are conspicuous because of their attainments. We have the AMERICAN JOURNAL OF PHARMACY with its large subscription list. Our geographic location is most advantageous, for Philadelphia is not only a great center of medical learning, but is the great industrial center of the country—certainly as to the chemical industries, and the manufacture of medicinal products. Moreover, we are in a position to offer post-graduate courses, and a foreign student can here prepare for the higher fields in his profession.

To extend the sphere of influence of this College in the manner suggested, we must, if we expect speedy results, proceed precisely as Yale is proceeding; we must build and equip generously. Happily, our President, Admiral Braisted, and our Board of Trustees, are fully conversant with the opportunities and the possibilities of P. C. P., and are laying plans to provide a splendid physical equipment, to meet the needs of the expanded educational programme, and the increasing student body, from our country, as well as from abroad.

The College will continue to be essentially an American institution, primarily for American students; but as foreign students turn to America for the higher education, which it was formerly the custom to obtain in Europe, we may reasonably expect them to come to us in rapidly increasing numbers, for pharmacy, certain branches of chemistry, bacteriology, and for pharmacognosy. And our officers are planning accordingly, as did the institution in Connecticut.

J. W. S.

ORIGINAL PAPERS

STRAWBERRIES AT THE NORTH POLE AND APPLES AT THE EQUATOR.*

By Heber W. Youngken, A. M., Ph. D.

The possibility of partaking of strawberries and apples in regions of the earth remote from their native habitats and districts of production at first thought seems unlikely. Upon later reflection, however, the likelihood seems possible, since we realize that they may be canned, dried or even refrigerated. But the chance of being able to have them in a condition almost like that in which they would appear when gathered in fresh from the garden or orchard and placed on the table with little or no natural flavor removed, after transportation to either of these remote points is a far different proposition. Yet I hope to show before the conclusion of this lecture that the ingenuity of man has made it quite possible to enjoy not only the full flavor and flesh of strawberries and apples in arctic or torrid climes but in addition other fruits, vegetables and meats which are not produced in these regions.

The whole secret of being able to procure the kind of food you want where and when you want it is in its preservation. The reasons foods do not normally keep indefinitely are partly biological and partly chemical. The chemical agents responsible for food spoilage are called enzymes; the biological agents, microörganisms. All living cells of plants and animals normally contain enzymes that possess the power of changing substances insoluble in water into water-soluble substances without themselves suffering any change during their term of activity. These enzymes are produced by the living matter of the cell and remain active after the death of the cell. Some of them have the power of attacking carbohydrates such as starch or inulin, breaking these substances down into water-soluble sugars, others attack proteins such as albumens and globulins, splitting these up into water-soluble peptones, etc., still others attack fats, breaking them down into water-soluble fatty

*An illustrated public lecture, delivered at the Philadelphia College of Pharmacy and Science, Thursday evening, November 17, 1921.

acids and glycerin. Some of the enzymes are present in the cells of the food itself, others occur in the cells of microörganisms which attack food. All enzymes require a certain amount of warmth and the presence of water in order to get in their activity.

From the earliest period of the human race of which there are records man has strived to preserve foodstuffs available in season and region of abundance for use in times and places of scarcity. The ancients practiced sun-drying of food on a large scale.

The following are the methods chiefly employed in the preservation of foods: (1) drying, (2) salting, (3) pickling, (4) smoking, (5) refrigeration, (6) canning, (7) dehydration.

DRYING OF FOOD.

The methods upon which foods are dried are based upon the principles that sufficient heat kills enzymes and the removal of water inhibits the growth of microörganisms as well as prevents enzymic activity. In some instances protective layers may be formed through drying by changing the former relationships of tissue constituents. Thus, for example, in the curing of pork, the fat which is for the greater part isolated in distinct cells becomes diffused throughout the outer layers of the flesh and forms a waterproof exterior to the ingress of microörganisms.

The removal of water in foods to an extent below the minimum required for the growth of microörganisms is secured in a number of ways. The most common ones are the uses of heat either in the form of sun's rays or from an artificial source.

Sun drying is the oldest of these. In regions where the moisture content of the air is low, as in many of the fruit districts of California and other western states, exposure to the sun's rays accomplishes rapid drying. In this method insects and dust frequently have full access to the food.

In more humid localities and with other types of food, artificial heat is employed and so we have kiln drying and drying by means of centrifugal action.

Kiln drying is much employed in the preparation of evaporated foods. In this method materials are laid on a screened floor under which heating appliances are built. The mass of material is stirred up occasionally during the drying.

Drying by heat always results in concentrating the solutes.

The acids in the juices of many fruits, when concentrated, may be antiseptic, *i. e.,* retard the growth of microörganisms. Frequently the sugars present reach so great a concentration as to plasmolyze the cell contents of any microörganisms present and so prevent their multiplication.

The disadvantages of all of these methods of drying lies in the facts that they are slow, not all materials can be so treated and the products resulting do not regain their natural appearance, odor or taste when prepared for diet.

SALTING.

This is a method of preserving meats and fish. It has been used for many centuries and next to drying is the oldest process known. It is dependent upon the principle that salt abstracts water from the tissues of the fleshy food and so causes a concentration of the solutes within the cells too great for the growth of bacteria. It gives the food a paler color and extracts at least 25 per cent. of the protein content. The great disadvantage in this method is the danger of undersalting or oversalting. Undersalted foods putrefy in time. Frequently the putrefaction is masked and ptomaine poisoning occurs after eating these.

Oversalting destroys the natural flavor and extracts much of the nutritive substances.

PICKLING.

Pickling consists of the preservation of food in brine containing varying percentages of salt, vinegar, weak acids and occasionally condiments. Many foods such as olives, cucumbers, cauliflower, beets, and some meats and fish are preserved by this method. That pickling is not always a safe method of food preservation has recently been emphasized by many outbreaks of botulism poisoning from pickled ripe olives.

SMOKING.

This is a method of preserving flesh foods and flesh derivatives such as meat and fish. It consists of first placing the fleshy food in brine with or without condiments for a week or longer. A smoldering fire is then built in a specially constructed chamber.

The flesh foods are taken out of the brine and hung up, being exposed for varying periods of time to the wood smoke and heat.

The volatile substances in the wood smoke such as creosote, formaldehyde, acetic acid and other germicidal substances penetrate the food at least superficially and either kill any putrefactive organisms present or retard their growth.

REFRIGERATION.

Refrigeration is a method of preserving foods which is based upon the principle that cold inhibits the activity of microörganisms. During the past two decades it has revolutionized the meat and egg industries. In the meat industry it permits slaughtering to take place all the year round and great cargoes to be transported in refrigerating chambers across oceans and continents and through equatorial regions not much the worse for the transporting.

Foods preserved by refrigeration generally command a higher price than those preserved by other methods. This is in part due to the fact that the general appearance of cold storage food resembles that of the perfectly fresh article. In numerous instances, also, refrigeration, for a reasonable length of time, preserves not only the appearance but also the delicate flavor, chemical composition and nutritive value of the original articles.

During the storage of food it undergoes some loss of water and volatile principles by evaporation and various volatile principles may be absorbed from the air of the storage room. But by far the most important point to be considered in this connection is the behavior of the biologic content of the food during this period. It should be emphasized here that refrigeration not only impedes the growth of microörganisms but tends to preserve them as well. In addition to the organisms present in the food when it is stored, other microbes such as bacteria, yeasts and molds, may gain access to the food from time to time either by actual contact with other things or through the circulating air within the cold storage chamber.

As to whether these implanted forms will survive depends upon their nature and ability to adapt themselves to the conditions existing within the stored food. Some perish, others may survive in the passive condition, still others may survive in their active form, multiplying rapidly.

It has been known for some time that some bacteria can grow at a temperature of zero and that many can reproduce at a fraction of a degree above that point. If microbic activity is, therefore, to be inhibited, the food must be frozen.

Methods of refrigeration vary depending upon the article to be refrigerated. In the production of chilled meats, the flesh of mammals is first placed in a cold chamber at a temperature of about +2° for the first forty-eight hours and then stored at a temperature of +1° or +2°, if chilled meat is desired. During the chilling process the enzymes of the dead flesh and bacteria present are active, bringing about a ripening or curing, which makes the meat more tender and gives it a more desirable flavor. If the chilling process be allowed to proceed beyond the point where the muscle sugar is nearly completely fermented, the changes in the meat due to the decomposition of proteid material by bacterial enzymes makes it dangerous and unfit for consumption.

In the preparation of frozen meat, the dressed article is chilled in an air-chamber at —20° until it is frozen solid and later kept at a temperature of below —4°. Such meat remains practically unchanged for long periods. The difficulty arises when it is thawed. If warmed slowly the melting water crystals are absorbed by the protein material and the original structure of the flesh restored almost completely, but bacteria are always bound to enter in a prolonged process of this kind and cause some decomposition.

In order to prevent this the thawing is usually carried on rapidly and so the normal structure of the meat is not restored. It is softer, darker and moister than chilled or fresh meat and prone to rapid decomposition if kept at room temperature for even short periods.

In the refrigeration of fish and poultry, these articles are chilled by packing in ice immediately after death and frozen as rapidly as possible. In thawing similar changes take place as in frozen meat but the bacterial decomposition proceeds more energetically. After thawing is complete the products spoil rapidly.

Eggs should be stored at a constant temperature which should be between +0.5° and +1° and at a constant humidity of 70 per cent. saturation, if superior results are to be attained. But even with the best of control and precautions there is some deterioration in the cold storage article due to the facts that the enzymes within

the egg are not necessarily inhibited nor is the growth of all of the bacteria prevented.

Milk is more rapidly changed by bacterial activity than any other food. In up to date dairies it is therefore cooled immediately after it is drawn from the animal and kept at a low temperature until delivered to the consumer. But even at this low temperature the milk bacteria multiply slowly. Freezing alone prevents their multiplication. If the milk is very clean, however, it may be kept sweet for several weeks at a temperature slightly above the freezing point.

Fruits and vegetables are refrigerated at a temperature slightly above zero and at a constant humidity at about 60 per cent. saturation.

In spite of modern methods of refrigeration it is not practicable to ship fresh sea foods to distant inland towns or to send some perishable fruits and vegetables of the tropics to colder climes.

CANNING.

Canning is a method of food preservation the principles of which include the destruction of microörganisms which produce the fermentative and putrefactive changes by heat and subsequently sealing the container to prevent the access of more microörganisms.

The principle of employing heat in the preservation of food had its origin in the experiments of Spallanzani, who in 1765 boiled meat extract in flasks for an hour and hermetically sealed them, after which no change took place in the material. Spallanzani, however, was not aware of the real cause of these changes.

About the middle of the nineteenth century Tyndall and Pasteur successfully demonstrated that living microörganisms were always found where fermentation and putrefaction took place, that these organisms could be killed by heat and that if substances liable to decomposition which had been sterilized by heat were kept so that no organisms could gain entrance, they would keep indefinitely without spoiling.

But long before the causes of fermentation and putrefaction were known canning was discovered.

During the Napoleonic wars, the French Government faced the problem of maintaining an adequate supply of food for their

army and navy and offered a prize of 12,000 francs to the person who could invent the best method of preserving food. Stimulated by this offer, Nicholas Appert a Parisian confectioner, undertook the task. After several years of ardent investigation he discovered a method which he submitted to the Minister of the Interior. A number of substances which Appert had preserved, including meat, vegetables, fruits, milk and soup, were examined by the Bureau Consultif, a commission appointed by the minister, which included such men as Gay Lussac, Bardel, Scipion-Perrier and Molard.

This body reported that when the jars were opened after several months, the foods were found to be perfectly preserved and in every way satisfactory in flavor and appearance. On the strength of this report Appert was awarded the prize of 12,000 francs. It was not until the following year (1810) that Appert published his discovery under the title of *"L' Art de Conserver pendant plusiers toules les substances animal et vegetables"* ("The Art of Preserving Animal and Vegetable Substances.")

Appert's method consisted of enclosing food in glass jars which were then corked tightly, placed in a bath of boiling water, the time varying according to the article treated and taking the jars from the bath at the prescribed time and in a proper manner. Appert later used tin cans as containers.

The success of Appert's method was dependent upon sterilization and the absolute exclusion of air. These same principles are applied in the canning of today.

From France the canning method was introduced into England by Peter Durand, who in 1810 obtained a patent from the English Government for the preservation of a variety of foods in hermetically sealed tin cans and glass jars.

Among the first to introduce the process into the United States were Ezra Dagget and Thomas Kensett, who in 1819 began to manufacture canned oysters, lobsters and salmon.

In 1820 William Underwood and Charles Mitchell opened a canning factory in Boston, where they packed currants, plums, quinces and cranberries.

Enormous losses were experienced during the early years of the canning industry due to defective nature of the square tin cans. The square can finally gave way to the economically superior round can.

A press for manufacturing can tops was invented in 1850.

In 1883 a hand capping machine was patented and later various other kinds of machinery replaced hand labor.

The Civil War did more to stimulate the canning industry in America than any other factor. Today it is recognized as the main method of preserving foods in this country and likewise the most popular.

DISADVANTAGES OF CANNED FOODS.

It is a well known fact amongst chemists and physicians of today that the heat necessary to bring about the successful sterilization of milk, fruits, vegetables and meat destroys vitamines. These vitamines are regarded as absolutely essential for the growth, development and the protection of the body against certain diseases such as scurvy and beri-beri.

In writing on the vitamines, Col. Vedder, M. C., U. S. A., states: "It should also be noted that all canned food must be regarded as possible beri-beri producers. It has been shown by numerous investigators, including the writer, that heating to 120° C. destroys the beri-beri preventing vitamines in certain foods. All protein foods that are 'canned' must be subjected to about this amount of heat in order to kill all the putrefactive organisms and such canned foods are, undoubtedly, beri-beri producers when used in excess."

I have recently been informed by Mr. P. R. Buettner, of Danbury, Connecticut, that canned tomatoes retain some of their natural vitamines due to the protective power of the acid in this fruit during processing.

The second disadvantage of using canned goods is in their great cost of production. From four to seven ounces of tin plate are used for each container. To this must be added the cost of packing cases and the handling, canning and transportation of much water.

A third disadvantage is the fact that they have limited keeping qualities. There is always danger of crushing and spoilage in transporting them.

Moreover, most of these products, when prepared for the table do not possess the same appearance, odor and taste as those of the freshly prepared articles from the field or garden.

DEHYDRATION.

Dehydration in the modern sense of the term may be defined as the process whereby perishable foods with or without previous treatment are subjected to the action of carefully regulated currents of air in which the temperature and humidity are properly controlled.

The method results in the food products gradually losing water, but without giving up their color or flavor or having their cellular structure impaired. Accordingly, the dehydrated food will reabsorb water, swelling up to its normal size and appearance. When cooked it will have the same appearance, flavor and odor of freshly cooked material made from fresh vegetables.

Dehydration dates back to 1850 when Masson, a Frenchman, dried a large number of vegetables and fruits with a blast of warm air at a temperature near 70° C. Sometime later Passburg of Berlin obtained excellent results with vacuum drying apparatus. It was not, however, until the Boer War that products of this nature began to be manufactured on a considerable scale. During this period many thousands of pounds of dried vegetables, mixed so as to form a basis for an easily prepared soup, were produced in Canada and shipped from there to the British Army in South Africa.

Stimulated by the possibilities of marketing products of this nature on a commercial scale a number of Americans established factories in this country and by 1910 began to manufacture dehydrated vegetables and soup mixtures. These products, however, never became popular, partly because they were not quite equal to the fresh article, when cooked, and partly because of the great popular demand for canned foods.

War is without doubt a great stimulator of human ingenuity, no less in perfecting methods than in inventing new ones.

Just as the Civil War stimulated the introduction of new methods in the canning industry, so the World War established new methods and perfected older ones in the dehydration industry.

With the problems of supplying our armies in distant fields and our ships in foreign seas with a variety of foods, and the limit of our tonnage, the food situation became acute. More and more demands were made by the government for dehydrated products in order to save transportation of water and to provide our fighters with fruits and vegetables that could not be obtained in England

and France. Thousands of tons of these foods were shipped abroad during the World War to the forces of the United States as well as the Allies.

It was the dehydration process that probably enabled Germany to maintain her food supplies during the war. That it was successful in that country cannot be doubted when we consider the following statistics: In 1898 there were only three small dehydration plants in Germany. Eight years later the number in operation was thirty-nine, in 1914 it had increased to 488, in 1916 to 841 and in 1917 to about 1900.

By August first of this year there were twenty-nine concerns manufacturing dehydrated fruits and vegetables in the United States. To this may be added at least a dozen firms who manufacture dehydrated animal products.

The methods of dehydration employed at the present time are varied in details of procedure. All, however, are founded on the same basic principle, namely, to remove the water contained in and between the cells of the food so as to obtain a product which cannot spoil as a result of microbic or enzyme action.

The water taken away by these methods is only replaceable water and so the nutritional value of the food has not been altered. Moreover, if dehydration is applied while the fruits, vegetables or animal products are absolutely fresh, the flavor-giving substances are preserved intact. In the best grades of dehydrated products the rate of evaporation is such as to bring about the removal of water without rupture to the cell walls.

By means of this process the weight of the food is reduced from 80 to 90 per cent. and the bulk is diminished to one-fourth or one-sixth of the original volume. By means of compression the nearly dried material may be brought to a compact form, as, for example, in the Veco products. Not all the water is removed, the amount remaining varying depending upon the character of the food to from 7 to 15 per cent. But sufficient is removed to concentrate the solutes to the extent of producing plasmolysis.

The manner in which the material is prepared influences to some extent the quality of the product. If the first temperature applied to the fresh material is too high certain changes take place in many vegetables giving them an appearance of scorched or scalded substances and diminishing their water-absorbing power.

Accordingly, in dehydrating vegetables, the fresh material should be subjected to air having a low temperature and high humidity and gradually brought to a high temperature and low humidity.

METHODS OF DEHYDRATION.

The methods of dehydration employed at the present time are as follows:

1. Tunnel Systems. These consist of long chambers or tunnels into the end of which the fruits or vegetables are introduced on screens or racks and through which a strong current of dry air is blown. While there are several modifications in the arrangement of the screens and in the method of heating and driving the air, it may be said that in general the heat is supplied by coils of steam pipe and the air is forced in by powerful fans. In some plants the racks of vegetables are placed on trucks which run on tracks, so that the material is introduced at one end of the tunnel where the temperature is low and humidity relatively high, gradually moved on to where the temperature is higher and the humidity relatively lower and delivered at the other end in dry form. By this means the moisture is uniformly extracted by capillary attraction without destroying the cell structure. On account of the gradual reduction of the moisture content, the cells shrink slowly without breaking down and the product retains all of its natural flavor, color and food value. In other plants the tunnels have side openings where the trays are inserted and removed by hand.

In the Hammond tunnel system, the patents of which are owned and controlled by the United States Dehydration Company of Denver, Colorado, the prepared fruits, vegetables or animal foods are placed in a rectangular tunnel and gradually conveyed through it, the moisture, temperature and rate of air flow all being properly coördinated. The air is allowed to take its course straight through, passing over the top of the trays or underneath them.

Most of the products are steam blanched or dipped in hot water before being introduced into the drier, which operation has been found quite necessary in preserving the color and keeping qualities of vegetables.

The Cook-Kelly process employed in the manufacture of "Cookelized foods" is another of these tunnel systems. In prepar-

ing foods by this process, fruits and vegetables are brought into the factory and washed, peeled, pared, sliced, cubed or riced, put on wire screen trays and placed in a rectangular tunnel approximately thirty-five feet long. Heated air is blown through this tunnel, the currents of this air taking the form of a sine curve as they go upward through one tray and downward through the next and so on. The trays are shoved along periodically which causes the air to reverse its passage through the products on the tray from time to time, evaporating the moisture from the products and carrying the moisture off through the other end of the tunnel.

2. Vacuum Methods. These have been employed with success in the dehydration of fruits, vegetables and animal products.

The apparatus consists of a heavy cast iron chamber containing a large number of steel shelves heated either by steam, hot water or electricity, a condenser, and a vacuum pump to exhaust the air from the chamber and maintain a high vacuum on the system.

The material to be dried is placed on flat screens which slide into the shelves. Heating is partly by conduction from the metal trays and partly by radiation from the next shelf above. The temperature is regulated by a thermostat, so that overheating is impossible. Through the constant application of a vacuum to the process, the water vapor is removed and the material dehydrated.

This method is particularly advantageous for the dehydration of potatoes and apples or other vegetables containing an oxidase ferment. It is this ferment which causes the darkening of such materials when their flesh is exposed to the air. Since air is removed from the chamber, no darkening results by this process. However, if such vegetables are subsequently placed in water, darkening will result, since the ferment has not been entirely destroyed. This is overcome by blanching or steam treatment before the foods are dehydrated.

In the dehydration of milk and eggs by the vacuum method, heated rollers are employed. These, with various attachments, are enclosed in a chamber in which a high vacuum is maintained. The heated roller picks up a film of egg-pulp or milk which dries rapidly under reduced pressure and is continuously scraped off by a knife as dried flakes or powder.

In the dehydration of meats, this method is probably unequalled by any other one in its effectiveness. Large steaks and chops can be handled without oxidation and completely dried. The fats remain white and are not melted. The product is essentially raw meat with water removed. Usually a temperature of 130° F. is employed.

Fish, lobster meat, clams, oysters, shrimps and other protein foods that ordinarily putrefy easily can be preserved in excellent form by this method. Since these products are dried to about 30 to 35 per cent. of their original weight, the concentration of the solutes is too great to permit bacterial development.

Most fruits and vegetables require higher temperatures than those to which flesh foods are subjected when dried by this method.

With some of the products this method gives good results but is rather severe with others, tending to break down their cellular structure.

3. Kiln Method. In this method of dehydration, square chambers with sloping roofs and perforated floors are utilized. The floor is heated from below by a stove or furnace. The materials to be dehydrated are spread on the floor to a depth of four or six inches. The hot air from the heating device passes up through the vegetables, removing the moisture, which is conducted through a ventilator in the roof. The mass of vegetables is turned over now and then by men with shovels during the drying. The advantage of this method is mainly its cheapness. The disadvantages are those of overheating or underheating. However, a number of products made thereby have proven satisfactory.

4. Special Dehydrators. A number of special types of chambers or machines are now in use, differing from those previously considered only in certain details of construction. Many of these have appliances to carefully regulate the drying.

KEEPING QUALITIES OF DEHYDRATED FOODS.

That dehydrated foods will keep for a long time, if properly prepared, is evidenced by the following occurrence: During the Boer War the British Army in South Africa was supplied with thousands of pounds of dehydrated vegetables mixed so as to form

the basis of a quickly prepared soup. At the close of the war one of the Canadian manufacturers was left with 30,000 pounds of this mixture for which he could not find a market probably due to the fact that consumers much preferred to buy such vegetables in the recent condition. He placed it in barrels which were paraffined and stored it away. Fifteen years later, after the outbreak of the World War, these were shipped to the British Army in Europe and used in the preparation of soups of splendid quality.

If dehydrated foods are properly prepared and kept in paraffined containers free from insect pests and ingress of moisture, there seems to be no reason why they should not keep for indefinitely long periods.

ADVANTAGES OF DEHYDRATED FOODS OVER OTHER PRESERVED PRODUCTS.

Dehydrated foods are superior to dried or evaporated articles because they regain the natural appearance and keep the natural odor and taste of the fresh article, when prepared for the table. Moreover, they have better keeping qualities.

Their advantages over refrigerated articles lies in the saving of cold storage charges, in the lessened transportation charges and in their superior keeping qualities.

Their advantages over canned foods lie in the great saving in freight charges (since the water content is reduced to 5 or 10 per cent.), in their freedom from spoilage, their greater ease of handling, their superior keeping qualities, and in the cheap containers that may be used. Moreover, there is no danger of botulism, nor are any of the vitamines destroyed.

Dehydrated foods can be shipped to any part of the globe without deterioration.

POSSIBILITIES OF DEHYDRATION IN THE UNITED STATES.

While much has been accomplished in the field of dehydration in the United States since the beginning of the World War, the surface has only been scratched. A goodly number of vegetables, fruits and a few animal products are being dehydrated successfully while scores of others have not as yet been taken up.

Each kind of vegetable or animal food must be studied separately in order to properly perfect its best means of drying by this method.

Dehydration is destined to stabilize the crops of the nation. Year after year, decade after decade, we are confronted by either feast or famine in respect to certain fruits or vegetables.

A good crop one year with correspondingly low prices has often been followed by a small crop the following year with high prices. With an extension of this industry the surplus of years of great yield can be stored and made available in later years when prices are higher and the crop leaner. In a short time the amount of planting would be equalized and all would be able to secure an adequate supply of these foods at normal prices.

Again, dehydration is destined to conserve food materials. It is a notorious fact that about half of the perishable fruits and vegetables grown in this country is wasted annually on the farm, at the freight station, in transit or in the hands of the commission merchant both as a result of poor transportation facilities and irregularities in marketing.

According to the *Los Angeles Examiner*, "only 40 per cent. of the California products contributed to relieve the famine sufferers in China ever reached them in edible condition." "Had the wasted 60 per cent. been dehydrated, it would not have failed of its merciful purpose."

Again, on account of the strict grading laws enforced by the Potato Growers' Associations, it is estimated that about 50,000 bushels of No. 2 undersized, sound potatoes are annually lost to farmers.

The potato dehydrating industry is comparatively recent in America and dehydrated potato flour is being manufactured from some of the previously wasted material. With the spread and development of this and other allied industries much of what had previously been wasted will be conserved for the benefit of the people. The dehydration of the sugar beet and the banana offer wonderful possibilities in this direction.

It is conceivable that dehydration now in its infancy, will within the next decade, when the nature of its products become more generally known, rival, if not outstrip, the other processes of preserving foods.

A CENTURY OLD CHEMICAL DICTIONARY.

By James F. Couch.

In a recent little volume [1] Dr. Edgar F. Smith has described the lifework of one of the earliest of American chemists, James Cutbush. While the whole essay will prove of interest to the scientific reader, pharmacists will be especially interested in learning that Cutbush styled himself "chemist and apothecary" and that, in 1812, he advertised a course of lectures on "theoretical and practical pharmacy" probably delivered "at the Laboratory in Videl's Court, in Second, near the Corner of Chestnut St." in Philadelphia.

It is not my purpose to discuss the excellent contribution of Dr. Smith. That has already been most satisfactorily done by the pleasing pen of Dr. C. E. Munroe.[2] But I wish to call attention to one of the many publications of Cutbush, perhaps not his most important contribution to American scientific literature, but one which serves the very useful purpose of a base from which to measure progress. In 1821, a century ago, Cutbush published his "*A Synopsis of Chemistry, Arranged Alphabetically: comprehending the names, synonima, and definitions, in that science.*" This is a little book of 85 pages, 9 by 14 cm. in size, bound in boards and it appeared at the time when the author was acting professor of chemistry and mineralogy in the United States Military Academy.

The chief interest of this work is that it presents a general view of the state of chemical knowledge just a century ago and permits us to observe the advances and the changes which the past hundred years of intensive scientific activity have occasioned.

Much of the old involved nomenclature of early chemistry is present. We read of "hydriocyanic acid" (p. 30) and of "hydro-oxydates" (p. 31) yet, throughout the book, there is a minimum of this sort of terminology and the whole is clear, concise, and phrased in simple language. There is not a chemical formula in the entire text which is not surprising for the theories of valence were not yet formulated. We must remember that Kolbe was born in 1818, Frankland in 1825 and Kekulé in 1829.

[1] James Cutbush, "An American Chemist," 1919.

[2] Book Review, *J. Am. Chem. Soc.* 43, 1743 (1921).

Some of Cutbush's definitions can hardly be improved upon at the present day. Chemistry he defines (p. 17), "That science, which treats of the action of bodies on each other, and having, for its object, the discovery of their constituent principles, the results of the various combinations, and the laws by which these combinations are affected." Analysis is defined (p. 10), "The separation of a substance into its constituent parts." Carbonates (p. 15), "Salts formed by the combination of carbonic acid with a base." He possessed a clear idea of neutralization, (p. 45), "When certain substances unite, and lose their individual properties, they are said to neutralize each other."

Cutbush, too was up-to-date. He speaks of "molecules," of iodine, which had recently been discovered, of compounds (although he does not define this term), and says of "phlogiston" (p. 52), "An imaginary element. A constituent part, it was thought, of all inflammable bodies."

He includes notices of "morphia," "nicotin," and "strychonin." Of maceration he says (p. 37), "The process of softening a substance, by steeping it in a fluid, without impregnating the latter." This is, of course, quite contrary to the modern meaning of the term. Rectification is (p. 63) "Distillation repeated as often as circumstances require."

The erroneous or primitive ideas prevalent at the time find expression in the definitions for latent heat (p. 36) "Heat chemically combined, not appreciable by the senses," oxydes (p. 49) "Combinations of oxygen with different bases, not possessing, strictly speaking, acid properties," and for affinity which may be "single," "double," or "disposing." Disposing affinity apparently is emulsification; double affinity is what we should now term double decomposition. Single affinity is defined (p. 7), "When two bodies are united and are separated by a third, single affinity is said to take place." Hydrogen peroxide is termed "peroxidized water" (p. 51) and fermentation (p. 24) is "A peculiar spontaneous process, which bodies undergo, when exposed to a proper degree of heat, and for a certain length of time." Nevertheless we suppose that the factitious blondes were as attractive and the brewed products as seductive then as at any time since.

Magniloquent titles are not lacking; bread making is "panification" (p. 51), the art of assaying metals is the "docimastic art"

(p. 22), "eliquation" is the separation of substances by fusing out one of them. Sir Humphrey Davy is accused of fathering the terms "phosphorane" and "phosphorana" for the tri- and penta-chlorides of phosphorus respectively (p. 52).

Boric acid is termed "narcotic acid" (p. 45) and "narcotic salt" (p. 66). While nitrogen is "mephitic gas" (p. 11), carbon dioxide is "mephitic acid" (p. 39). Carbonic acid is "calcarious acid" (p. 14) and the "acid of sugar" or "saccharine acid" is oxalic acid (p. 72) probably in reference to its production by heating sugars with nitric acid. Coagulation is defined (p. 18), "An operation, by which fluids are made clear, by the use of serum and albumen, and the application of heat." "Butter of Arsenic" is arsenic pentachloride (p. 14) and "green fecula" is the term given chlorophyll (p. 24). A gas is (p. 27) "A combination of a base with caloric; as hydrogen and caloric, forming hydrogen gas." Elements (p. 23) are "first principles. Simple substances. Undecomposable substances," and effervescence is "the sudden escape of a gaseous substance, accompanied with an intestine motion," (p. 23).

As an instance of the medical superstition then prevalent Cutbush's definition of "miasma" may be quoted, "Matter of contagion. Certain bodies are known to exist in the atmosphere, we will not say combined with it, which exert a powerful action on the human body, and which have been termed *matter of contagion.* Miasmata may proceed from the decomposition of vegetable, or of animal substances, and the atmosphere may be tainted by other causes. In all cases, however, it has been supposed, that a certain noxious matter is dissolved in, or diffused through the air, and that by the action of this matter on the living body certain diseases are produced. When noxious effluvia arise from putrefaction, it is known that certain agents will destroy it; hence the vapor of nitric acid, of muriatic acid gas, and of oxymuriatic acid gas, or chlorine, have been used with great success, in disinfecting air." (p. 41.)

From the foregoing one can appreciate the mists which clouded the conceptions of chemists a century since. Superstition, thaumaturgy, fallacy had to be removed, a science had to be organized and a simple practical system of notation had to be invented. Very little of our present chemical knowledge existed and what there was appears ill-defined and not coördinated. The tremendous importance of the contributions of such men as Berzelius, Liebig,

Dumas, Gerhardt, Pasteur, Faraday, van't Hoff, and Fischer, with their contemporaries stands forth in *alto relievo* when we contrast the present year with hundredth predecessor.

Much of Cutbush's text is now only curious; some of it is rather absurd. We cannot help but hope, however, that since this sort of thing is one way of measuring progress, our successors in 2021 will find much of our present thought ancient and perhaps a trifle ludicrous.

A CHANGING VIEWPOINT.

Dr. Henry Leffmann,

Lecturer on Research at the Philadelphia College of Pharmacy and Science.

[French scientists are giving earnest attention to the changed views as to the nature of matter and energy brought about by the electron theory and the doctrine of relativity. Several works have recently appeared extending the application of these to almost complete reversal of the usually accepted ideas. While the doctrine of relativity has found enthusiastic supporters in France, it has also found strong opponents, so that it may be said that intellectual Gaul is now divided into two parts. A work by Louis Rougier, a professor of philosophy in Paris, contains a statement of some of the newer views. Issued under the title *"La Materialisation de l'Energy,"* the book has been translated into English by Professor Masius, of the Worcester Polytechnic Institute, as "Philosophy and the New Physics" (Blakiston, Philadelphia).

The text given below is a close translation from the original French and is presented as a summary of some of the new views on the relation of matter and energy. Many will find the statements strange, but it must be remembered that theories that are now generally accepted were condemned when first propounded. This was the case with the stereochemic formulas, especially the benzene ring theory of Kekulé.

As a commentary on the claim for newness the following dialogue from a Greek farce, "*The Clouds*," by Aristrophanes, which is more than twenty-three centuries old, may be quoted.

Strepsiades.—You swore, just now, by Jupiter.

Phidippides.—I did.

Strep.—See what a good thing learning is. There is no Jupiter, O Phidippides.

Phid.—Who then?

Strep.—Vortex reigns, having expelled Jupiter.

* * * * * * * * * *

Phid.—Who says this?

Strep.—Socrates, the Melian, and Chaerophon, who knows the footmarks of fleas.

Henry Leffmann.

The discoveries of modern physics have led physicists to two very distinct conceptions of the universe. One of these can be designated as the "dematerialization of matter." Its essence is that it reduces the conception of matter to individual points of stress, condensation and even annihilation, in a medium possessed of inertia and mechanical properties, the "dialectric ether" of Faraday and Maxwell. An electron becomes a simple cavity in the ether, which behaves like a projectile moving through a perfect fluid, without a viscosity. On the sides of the projectile, a fluid cushion is formed, and behind it a zone of deep dead-water; the essential inertia will accrue from all the inertia of the wake thus created back of the moving mass. A part of the muzzle-energy will be expended in overcoming the inertia simultaneously with that of the moving body, but when the movement is once initiated, it will be perpetuated without resistance since the body will carry its wake with it. The electron cannot have any inherent inertia, but cannot be displaced without dragging with it the surrounding ether attracted to its lines of force, and its inertia will proceed from that of the ether, thus disturbed, which will originate an electro-magnetic wake. Matter is thus converted into a space in the ether, and the ether gains in substance what matter loses.

This conception is derived from the labors of Faraday, who brought into notice the importance of the medium in electric and

magnetic phenomena. The attention of physicists has been directed to the study of the magnetic and electric fields, in the interior of which the energy is concentrated, matter serving only as a support for such fields. Instead, however, of conceiving these as real, and existing in an independent fashion, physicists have claimed to explain them by the mechanical condition of a hypothetical medium—the ether—electric energy being only the potential energy of its deformations, and magnetic energy, the kinetic energy of its displacements. The ether becomes the active medium, in which the transportation and transformation of energy are controlled by the equations of the magnetic fields due to Maxwell and Hertz, and thus, little by little, matter is emptied of its physical content in proportion as the ether becomes the sole real substance.

Going further, Gustave Le Bon has written the epic of the metamorphosis of matter. Let us imagine that the electrons—into which are finally disintegrated the molecular structures that constitute substances—may be created by vortexes in the interior of a universal fluid, analogous to the ether of Lord Kelvin. Instead of considering these vortexes as indestructible, conformably to the hydrodynamic equations of Cauchy and Helmoltz, let us assume, offhand, that they diminish in the extent of the fluid, as occurs with a waterspout, passing into ripples by gradual retardation of their velocity. The rotatory energy of the electron will be transformed into radiant energy, which will be lost in infinity, as it sweeps through all space. Thus, matter is segregated into electrons, which are themselves resolved into etherial undulations, so that there is a definite loss of matter, without a recovery of energy. For the principle of universal constancy, which the Greek philosophers put as the basis of natural philosophy, and is quite comprehensible, "Nothing is created; nothing is destroyed," should be substituted the dictum, "Nothing is created; everything is destroyed." The universe moves towards a complete bankruptcy, and the ether, which has been proclaimed as the matrix of the worlds, becomes their tomb. Le Bon is a Zarathustra, who, in elegant phrases, announces the "Twilight of the Creation of the Gods" after their death.

These conceptions encounter insuperable difficulties. The ether is given contradictory mechanical properties, and the attempts at explanation of electro-magnetic phenomena based on these assumptions are wrecked. If the ether exists, Fizeau's experiment shows

that it cannot be wholly controlled by matter; that it cannot be partially so controlled is demonstrated by the principle of action and reaction; the principle of relativity implies that it cannot be immovable. More difficult of formulation than Proteus, there is nothing more to be done than to prepare a report of its bankruptcy. To these vagaries, the theory of Le Bon adds new difficulties. The equations of Cauchy and Helmholtz show that a vortex developed in a homogeneous and incompressible, perfect fluid is everlasting. The electronic theory of radiation binds the appearance of these to the electrons, which play the part of agents, in presence, in the transformation of the different forms of energy into radiations, and which allow these transformations, their own conditions being unaltered, as enzymes in catalysis. Their disappearance will, therefore, involve exactly that of the radiation in which one would want to cause them to be annihilated. Finally, if we abandon the principle of invariance, as laid down by the Greek philosophers, there is the possibility that science itself will be put in question. Science, being a search for the laws of nature, that is, the invariants of universal evolution, will be no more of value in a primary approximation than for systems in which the disintregation of matter and the radiation of energy to infinity will be practically insignificant. The metaphysical problem will appear as to why the universe if it has had no beginning, has not been annihilated milleniums ago in an ether "immobile and dormant."

To dismiss the theory of the ether will lead us to an entirely different view, that of the "Materialization of Energy." Energy will emerge from the domain of the "imponderable," to take on substance, like spirits assembled from the Elysian Fields when Ulysses appeared on the Cimmerian shore. It becomes possessed of inertia, weight and structure, and manifests itself under two forms, one by reason of long ascription, termed *matter*, the other, *radiation*.

Matter is characterized by its structure, that is to say, by the number and nature of the electrons, and perhaps, positive nuclei, which constitute it, as well as by its property of being moved by active velocities, in correspondence to a system of reference, from zero to that of the velocity of light.

As Ostwald has said, we know it only by its energetic effects—the electric field of the electron at rest; the magnetic field of the electron in motion, the gravity field of molecular structures formed

by the aggregations of the electrons, and the kinetic actions due to their *vis viva*. The electron is shown to be a particle of negative electricity, so that matter is, in truth, a form energy, largely accumulated in a very circumscribed area in space. It does not lose for all that as it does in the theory noted above—the reality and substantial nature—that external perception and ordinary sense have mutually attributed to it up to the present, inasmuch as the energy which is its essence is possessed of mass, weight and structure.

Radiation is a form of energy, which is no longer held to be propagated by a sort of waves throughout a hypothetical medium, but as sent forth in the form of discrete particles through empty space, with the uniform velocity of light. It also is possessed of inertia, gravity and structure. The analogy of its basic properties with those of matter, enables us to explain its action on the latter. A luminous radiation, representing a certain amount of movement, is strictly comparable to a material projectile. For this reason, by virtue of the law of action and reaction, it exerts a repulsion on the material source that projects it, and propulsion on the material obstacle that absorbs it. The ancient metaphysical problem of the action of the imponderable on the ponderable, of force on matter, which is postulated under the most recent and most urgent form, that of the pressure of radiant energy, disappears at once, being, in fact, a pseudo-problem.

The distinction between matter and radiation should not at any time conceal an antagonism, in some respects, profound; that of the electromagnetic field and the gravitational field. This antagonism can be expressed still in the older terms "energy" and "space." Radiation, caused by alternating electromagnetic perturbations, matter, the elementary particles of which are nothing but condensation of the electromagnetic field, appear equally as simple modes of the latter. In contrast, this latter seems not reducible to the gravimetric field which is identified as "Einstein space." A point in space can be conceived independently of an electromagnetic field, but not independently of a gravitational field. In truth, outside of the latter, there can be no measurement, no luminous radiation, no possibility of the existence of the standards of measure and time, and, consequently, no apprehendable physical reality. Though connected by a causal relation, the electromagnetic and the gravimetric fields are logically separate.

Does such a statement lead us to the view that this opposition is absolute, that is, that we can never comprise energy and space, the electromagnetic and the gravitational fields in a single representative scheme? H. Weyl, a mathematician of ability, has advanced reasons for thinking otherwise, and has written an essay containing a notable synthesis in this view. This statement of theory has not met the approval of Einstein. Its exposition would exceed the limits of this work, but it deserves to be mentioned.

THE OCEAN OF VITALITY AND RESERVOIR OF LIFE.[1]

JOHN URI LLOYD.

"Lo, the poor Indian, whose untutored mind,
Sees God in the wilderness, and hears him in the wind."

Listen. Be you of intellect profound, or of research into life's mysteries deep. To you, be you young or be you old, as years are counted, if you will but think, the above motto surely must appeal.

Come! Let us seek a library where may be found records carrying slivers of knowledge that men in the passing along have put into print, men of scientific conspicuity, men of educational opportunity, men primitive but yet observant. Let us open these volumes, consider their contents. Among them we find a neglected publication, written by an empiricist who lived in touch with Nature. Almost is he fully described by the motto that heads this article.[2] Turn to Chapter I, the very beginning of his Introduction. Let us quote:

"An Indian, it is storied, when asked what he thought was the reason of the ebbing and flowing of the tide, made answer: 'You know there is a great deal of odds between a big creature and a little one; a horse draws his breath a great deal slower than a mouse; the world is a *big creature*—he draws his breath only twice in the day and night; that makes the tide.'"

[1] Fragment of a lecture connected with (introducing) "Vegetation," delivered in the Eclectic Medical Institute, Cincinnati, about 1879. Permission to publish in a Medical Journal reserved.

[2] "The Indian Doctor's Dispensatory, being Father Smith's Advice Respecting Diseases and Their Cure." By Peter Smith of the Miami Country, Cincinnati, 1812. (This is the first book under the name Dispensatory, printed in America west of the Alleghenies.)

The Story, the Great Deep.—Comes not from out the "Great Deep" that breathes twice each day,—the material we may as a blanket term, call Life Pabulum, be it organized or unorganized? That substance, be it earth or stone, be it hot or cold, which, seemingly dead and devoid of self, needs but the touch of life to become a vitalized entity? Go to the hills about, study their frames,—behold we not therein the skeletons of fish and shell, of trilobite or creeping thing evidence of old ocean's handiwork? Seek the desert and the canyon's cliff,—study the pages left in dust and strata,—comes not to mind-view a bygone time when this dry dust and these lofty walls were a part of ocean's floor? Turn to the petrifications of gigantic trees that, among ocean's debris, lie scattered over plains, hills and valleys, amid the western wilds,—Do not these, in their broken selves and surroundings, indicate that perhaps not once alone but repeatedly, they may have been sunken below ocean's wave, to be again uplifted? Behold the volcanic peak, speaks it not in its cloud clasp, ocean's kinship? Even though it be remote from the sea and inactive since all time, as men count time, or be it today a fire-cone center or a new-made island, perhaps the seed of a continent to be, feeds not old ocean its fires, is not the cloud mantle but a touch of her wealth? Claims she not that mountain as her own?

Consider the story told by the fossil shells that voiceless bespread all Central Western America, and elsewhere the world throughout. Imbedded are they in the hill's crest, as well as in the soil of the sunken valley. Go where you will, study the record of it all, earth and stone, mineral and salt. Be they as unorganized by the touch of what we call life as are the sands of the shore; or be they fossil relics, once vitalized,—Claims not each, relationship to mighty Ocean, in language mute? Say they not, as clearly as do the fossil teeth of shark in Florida's sands, "Once I was beneath the ocean's wave—a part was I once of Old Ocean's realm?"

Life.—What is this thing men call life? This evanescent something that, catching air, earth, water and sunshine, blends them into creatures new and strange? Whence does it come, where does it go? Suffices it to say that life alone is not an entity, that it, of all else, is but a transient nothing. That air and earth, elements and all materials ponderable, are mutable in

form, but yet eternal in the ultimate, whilst life without a home is as a vacuum but yet vitalizes one and all "living" things; only speakable as a word, but no more self-existent than the vibration of a leaf. A conception that exists not but makes all else alive; comes it from out of nothing, a nothing in itself to vitalize dead matter and next, perish forever? Suffice it to say that light and heat, electricity, force and energy, in their various modifications, pass one into the other, no more destructible than are objects of gross weight, but yet that the subtle thing, Life, imponderable, known only by its mighty influence, is but an ideality? A satisfactory definition to him who meditates in book-lore only is that life is "the state of being, which begins with generation, and ends with death."—*Webster.*

Accept such as this for want of data in the ultimate, and life stands as a marvelously evanescent conception; neither constitutional matter nor force modification is it, neither weighable nor measurable, neither warm nor cold. Unreachable by aught than observation of effects, observable only in its action, conceivable only by utilization of life-made intellect which in denying *life* a place in force fields condemns its own self into the realms of vacuity be it of the past, the passing along, or the ending.

Take this definition and we find that "life" is as hypothetical as is "spirit," as everlasting as is a theoretical soul entity, and yet as transient as are the fleeting moments that have neither substance nor energy in form nor conception; that life-bred, mind-creations come and go "as the moments pass," but cannot be "corrolated" with aught known as matter and force?

And yet, is it not true that *conditions* favoring imponderable life phenomena can be studied as can those governing the transmigrations of the material atom? Do we not know that heat and light, electrical conditions and material surroundings, are a part of life's necessity? But is it not also true that, although neither one nor all are *life,* neither one nor all if devoid of "vitality" can be utilized by man to make a living creature? The chemist has never caught it, the microscopist has never seen it, the mathematician has never calculated its size or shape, the theorist pauses.

Pass now the speculative field in which speculation is inadequate where outreaches beyond materialistic fact overwhelm him who in finite mind, presumes to dare infinity. Bold must be the

man, who creeping on a speck that floats in immeasurable expanse, ventures even to ask how beginningless time commences and passes into time's everlastingness. How nothingness itself sprung into existence, how void of something came into space, how, from out that spaceless hypothetical vacuum *nothing,* matter was created? Audacious must be the human who presumes to ask himself how a Creator of it all could have been himself created before creation began, how came the initial God of all—who of all mankind, in the face of infinity, ventures even to ask, what is the atom's origin, be it what it may, much less what is "life's origin"? Who of modern or ancient savants ventures to speculate about the outreaches that in microscopic depths lie beyond the infinitely little, who is it that bounds the overwhelming, unthinkable depths that lie in space beyond the telescopic great?

And yet, this we know, old ocean, a reservoir of activity, beats every shore, she laps the sunshine and her waves roll in and back again, her vapors cloud the earth, showering life-giving rains, and reservoirs of snow, her tentacles as rills and rivers thread the land. Out of the riches that lie in her bosom and the moisture of the breath with which she envelopes and nourishes all that lives, come the endless forms of creeping and growing things. Is not her's "The Ocean of Vitality and Reservoir of Life"?

SAFEGUARDING THE GATEWAY TO PHARMACY.*

By Prof. J. W. Sturmer.

"All men are created equal," wrote Thomas Jefferson in the document which sets forth the fundamental tenets of Americanism. And so they are, in the sense in which the phrase is used here. But certainly far from equal in physical power, mental capacity, or in those psycho-physical or psycho-physiological characteristics which make for courage, energy, perseverance and the determination to carry a task to a satisfactory conclusion. Equal in the sense that no man in America is born a serf and another his master, but not equal in the capacity for development and for the grasping of opportunity. Not equal—we may say further—in ability to distinguish right from wrong,

*Read at the 1921 Meeting of the Pennsylvania Pharmaceutical Association.

good from bad, or what is wise from what is foolish. "All sorts and conditions of men" there are, and nothing is more firmly established than that each individual has an individuality.

Yet schools and colleges must deal with boys and girls, and men and women, in groups. Hence no system of education, general or special, fundamental or vocational, can be expected to reach perfection, for the human equation in the student-body is the ever-present disturbing factor.

When our draft boards disclosed the percentage of physically unfit, the information was found startling. And when the army published the results of its mentality tests, these findings were no less disquieting. Yet there is no reason to doubt that the mental disparity disclosed has existed in the human race for centuries.

To be sure, Uncle Sam's enlisted men showed a wider range of mental capacity than could be found in the classes of any school. Indeed, no school could operate, no curriculum could be devised, with a student body representing such extraordinary inequalities.

As regards colleges, their curricula and teaching methods are based upon the assumption that they must deal with selected groups. In the terms of the army groupings, college classes are made up of students whose mental capacity places them in the groups A, B and C; those who would rank as D and E having been sifted out by the elimination process of preliminary education.

In other words, elementary and secondary education not only prepares for college, but also excludes those who are not fitted to profit by college training. It is with this fact in mind that so much stress is now placed upon entrance requirements for pharmacy. It should be remembered that we are generalizing, and that we cannot be turned aside by exceptions, which disappear from view when we consider humanity in mass. And by and large, it is unquestionably true that the quality of the personnel of pharmacy will depend as much upon the entrance requirements exacted by the colleges as upon any other factor.

But, some may say, having in mind the early periods of pharmaceutical education, did not the colleges turn out excellent men prior to the high school entrance requirement? Yes. But let us see how conditions differed. At that time college training

was not a legal requirement, and college classes were made up, speaking generally, of students who were there because they wanted to be there. And for those who entered pharmacy through other routes, the colleges had no responsibility. The apprentice system was then in vogue, and only the most promising apprentices were encouraged to go to college. So the apprentice system very effectively reinforced the schools in eliminating those who because of incapacity, lack of energy, lack of perseverance, or of adaptability for the work, or because of moral deficiencies, were unfit for college. This is no argument for the re-establishing of the old order of things, and certainly no argument against the college pre-requisite clause of the pharmacy law, which has proven an inestimable benefit to the public. It is simply a statement of facts and an explanation why certain readjustments became necessary.

Under the present conditions with the apprentice system only partially operative, and legal regulations compelling all who wish to qualify as pharmacists to do so through the college, we can readily see that the entrance requirements now have added significance, and are of greater importance, for now we must depend upon the high schools almost wholly for the sifting process, which will dispose of those who are unsuited for college. A peculiar aspect of the problem is brought to view when we compare the entrance requirements for medicine, engineering, dentistry, and the other professions with those now operative for pharmacy. For all other professions, and indeed for all other courses of collegiate grade, a complete four-year high school course is the admission requirement. These professions, therefore, get the benefit of all the selection which secondary education is capable of effecting. As long as pharmacy has an admission requirement lower than this, pharmacy colleges are bound to get more than their share of incapable students, for to the high school flunks, no other professional course is available. This is why the pharmacy colleges are glad to speed the day when the full four-year high school requirement will be uniformly enforced.

To be sure, we have had men who registered under lower requirements and of whom we may be justly proud. But our teaching problems have been made more complicated and our percentage of failures has been increased, because of the pres-

ence in the classes of students whose preparation was not adequate, and who would have been eliminated had the sifting process of the full high school course been brought into operation. Remember, we are discussing general principles and that we are quite willing to concede that some who fail to complete high school are forced out by economic pressure, and are not eliminated because they are unfit. However, the experience of other professions has proven that the most energetic and determined of these do eventually qualify, though it takes them longer to reach their goal.

Suppose then, in 1923, all the pharmacy colleges of the Conference make operative the four-year high school entrance requirement. Will this insure a satisfactory personnel for pharmacy? I wish we could answer yes, and say yes without qualification. But we cannot. There is yet one other matter to consider. It is this: Education is a selective process fairly successful in picking men and women who can *do,* and is helpful even in selecting those who will *do right;* but it cannot be depended upon as an infallible procedure which will exclude all the unworthy. Pharmacy is a calling involving peculiar responsibility—it is a public trust—and should be limited to men and women who may be trusted fully and unreservedly. It devolves upon pharmacy to guard and to keep pure the modern Pool of Bethesda, which through the instrumentality of science has been provided for suffering humanity. Therefore, we must insure the quality of the personnel of pharmacy.

In the archives of the older colleges may be found the certificates of character of the early students. These certificates were provided by the preceptors, and they disclose full knowledge of the candidate's fitness, mentally and morally, for his calling. No doubt these old documents explain why, despite the absence of definite entrance requirements, the graduates of the early classes acquitted themselves so well. Cannot we re-establish, so far as this is practicable, the old-time *character standards* as an entrance requirement? We have gone as far as we can in employing preliminary education to pick our students. What remains still to be done must be done by the pharmacists out of whose stores our candidates for admission come—and by the colleges, in establishing character standards for admission. Will the proprietors of pharmacies share with the colleges the responsibility

of guarding the gateway so that only the fit may enter pharmacy? We feel they will; for all in pharmacy must realize the necessity of maintaining high character standards for the personnel of pharmacy. Pharmacy is as great and as good as the men in it. No greater—no better.

KAPOK OIL.*

W. H. Dickhart and H. P. Trevithick.

Kapok oil is an oil which is made from seeds quite similar to cottonseed and which resembles cotton oil in many particulars, especially in that it gives a Halphen reaction which is just as strong and positive as that of cotton oil. Importations of the oil are quite rare.

The seeds are black, the size of peas, and have a white kernel. They grind easily and being free from lint are very easy to crush in a cottonseed plant. However, so far as we know, but one lot has been crushed in such a plant.

Lewkowitch gives widely varying figures for the characteristics of the oil, so that when we received a sample sometime since, we took the opportunity of determining some of the values for ourselves.

The oil as received was fairly clear, of a brownish color, and showed the following results upon analysis:

Moisture	0.45%
Insoluble Impurities	0.36%
Specific Gravity	0.9221
Iodine Value (Wijs)	94.9
Saponification Value	194.5
Index of Refraction at 20° C	1.4710
Unsaponifiable Matter	0.66%
Free Fatty Acids	12.13%
Refining Loss	35.0%
Color of Refined Oil—35 yellow	7.0 red
Titre of Refined Oil —° C.	28.1°
" " Soapstock —° C.	30.2°

Halphen Test—Positive, strong, immediate.

The Halphen color appeared just as fast as if the sample was cottonseed oil, showing a reddish tinge before the carbon bi-sulphide had left the oil.

*New York Produce Exchange.

ABSTRACTED AND REPRINTED ARTICLES

PHYSICS A HUNDRED YEARS AGO.* †

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Corresponding Member and Associate Editor.

By A. S. Eve, C. B. E., D. Sc., F. R. S.

A century ago science had recently lost three eminent men who had notably advanced our knowledge of electricity, dynamics and heat, Cavendish (1731-1815), Rumford (1753-1814), Watt (1736-1819).

The steam engine had appeared and was used for pumping mines, for locomotives and for the propulsion of ships; the notable discovery had been made, to quote the contemporary words of John Herschel, "A man's daily labor is about four pounds of coal." "Two pounds of coal would raise a strong man from the valley of Chamounix to the top of Mt. Blanc." "You can raise seventy million pounds weight a foot high by a bushel of coals." [1]

There had just begun that industrial revolution due to the use of coal and iron, which, for better or worse, has in a century transformed the world.

Every age regards its progress with a wholesome and justifiable pride. The achievements of preceding generations are dimmed in lustre by familiarity. The imagination is too feeble to form an adequate conception of the marvels awaiting discovery, ready to fall like ripe plums into the laps of successors. On the other hand, recent discovery always stands out with a delightful and refreshing vividness.

Now a hundred years ago people were thoroughly pleased with their discoveries, no less than we are today. It is sufficient to mention such successive discoveries as the spinning jenny (1768), spinning frame (1769), cotton gin (1792); the discovery of the planet Uranus (1780), the first air balloon (1783), and vaccination (1796).

*Address at the Centenary Reunion of McGill University.

†Reprinted from the *Journ. of the Frank. Inst.*

[1] The actual work done by a bushel of coals used in a steam engine was called its *duty*, a useful term.

Thanks to Newton and others, it was a just claim, in 1821, that more scientific progress had been made in the preceding two hundred years than in the whole previous history of mankind.

It is curious to read moreover the lamentations by Thomas Young on the enormous amount of scientific literature and the great variety of publications, which rendered it difficult or impossible to keep abreast with scientific discovery. How seriously has this evil increased during the past hundred years, until we seem doomed to be buried under our own records! And this trouble must continually increase with time.

Mr. James McGill was an enlightened citizen of Montreal with an interest in literary and scientific progress. It requires but a small stretch of the imagination to conceive of our founder sitting under an elm tree on Burnside Farm by the side of that little brook, with its rustic bridge and lovers' walk, which flowed past the spot where the Macdonald Physics Building now stands. The valley of that brook is still visible in the back lane and tennis court. And indeed in spring time, the brook itself revives and floods our basement.

Imagine him seated there and reading the following fictitious letter supposed to have been written about a century ago by a friend of James McGill, an imaginary professor of natural philosophy at the famous University of Glasgow, giving an account of a visit to London and Paris, and describing to our founder what he saw which was new and interesting in the scientific field. It is a matter of regret to me that I cannot read this letter to you in the good Scots tongue.

From Professor Robin Angus,
The University of Glasgow,
(Undated).

To Mr. James McGill,
of Montreal.

Dear Mr. McGill,

I am now fortunate in writing to you to give my promised account of a long projected visit to London and to Paris, and my description of the progress of recent discovery in natural philosophy.

I left Glasgow on the first of June and the roads were in good condition so that we made a swift and agreeable journey. One day indeed we traveled 59 miles in 11¾ hours, including time for baits!

On my arrival at London I quickly went to the Royal Institution and called on Dr. Thomas Young. I was fortunate enough to hear one of the 93 lectures which he is giving on natural philosophy. These lectures are shortly to be published as a book, a copy of which I will send you. His lectures were well illustrated by skilful experiments.

You are aware that Sir Isaac Newton suggested that light consisted of little bodies of corpuscles shot from the source of light traveling "with an eel-like motion" along straight lines. Now Dr. T. Young will have none of this theory, but he agrees with Huyghens that light travels with wave motion in some subtle and all pervading medium which is called æther. Huyghens thought that light consisted of waves with a motion of the æther to and fro in the direction in which light traveled, but Doctor Young points out, as did Newton, that light may be "one-sided" or polarized, so that it is essential to believe that the vibrations are transverse or perpendicular to that direction in which light moves. As indeed the French philosophers have very clearly proved.

Doctor Young has a large trough with a glass base, filled with water, illuminated beneath; and with a large mirror he projects upon a white screen the waves which are made upon the water by one or more pointers fastened to vibratory rods. In this manner he illustrates very clearly what is called the interference of light, well enough known to Newton, but a stumbling block to his corpuscular theory.

At the Royal Institution I met also with Sir Humphrey Davy, who has saved countless lives of miners by his safety lamp, where the flame is surrounded by fine wire-screen, preventing premature explosion.

The great Corsican ogre, Napoleon, scourge of the world, is newly dead. Yet in fairness it must be stated that he proved a good friend to science. In the midst of the war between England and France he gave, in spite of strong opposition, a great scientific prize to an Englishman, Davy, for his discovery of potassium and of sodium by electric separation. He caused a galaxy of scientific men to gather at Paris, and encouraged them in their work by every means at his disposal. Napoleon was a man who certainly knew that in science, too, "As a man sows, so shall he reap."

I met at the Royal Institution a young assistant of Davy's named Faraday who was full of insight and enthusiasm so that he promises to go far. He was greatly interested in electrical experiments.

You are familiar with electrical machines and Leyden jars, lightning rods and Franklin's experiment with the kite, and how he obtained electricity from the clouds. All these are well described in a little book by Doctor Priestly[2] which I sent you last year. But, as the Hon. Mr. Cavendish wrote, "It must be confessed that the whole science of electricity is yet in a very imperfect state"; or to quote my friend Doctor Young (p. 507), "The phenomena of electricity are as amusing and popular in their external form as they are intricate and abstruse in their intimate nature."

Suddenly there has come from Denmark a great burst of light, which we owe to Hans Christian Oersted. This illustrious man was born in 1777, and after passing with honors at school he received *free* residence and a small scholarship awarded to needy students.[3] After a distinguished career at Elers College he received a Cappel Traveling Fellowship which enabled him to visit the leading scientific men in Germany and France to his great benefit as it now proves to ours.

This plan of helping able students to secure a good university education and to visit other countries in order to appreciate scientific progress, has much to commend it to other countries and to all universities.

Many philosophers have endeavored to deflect a magnet with electricity, using an electrical machine with open circuit. Now Oersted was lecturing to his advanced students and he discovered, his class being there and then assembled, that with an electric battery and a closed circuit he could cause a current of electricity to deflect a magnet. Not when the wire is perpendicular to the needle, but when parallel. This influence will pass through wood and water and mercury and metal plates, excepting iron, so that the influence of the electric current on a magnetic pole is as it were in circles around the wire. Already Schweigger, at Halle, has invented a measurer of electric current called the Astatic galvanometer, where

[2] "A Familiar Guide to the Study of Electricity," 4th Ed., 1786 (J. Johnson, London.)

[3] *Nature*, p. 492, June 16, 1921.

two equal magnetic needles pointing opposite ways have been deflected by a current passing in a coil of wire round one needle, a most sensitive arrangement.

Davy, using the great battery of 2000 cells of zinc and copper at the Royal Institution, has passed an arc between two carbons giving a most brilliant light. Now this arc he has deflected with a magnet, showing that as a current in a circuit will deflect a magnet so will the magnet deflect the circuit if and when a current passes in it. Here then we have another example of the third law of Newton that "action and reaction are equal and contrary." Nay! Oersted himself hung up by a fine wire a small battery and coil and deflected it with a magnet. Hence we now have a new branch of science, my dear Mr. McGill, which we may call electrodynamics or electromagnetics. The great M. M. Ampère at Paris has made vast strides in this new subject.

And indeed I must pass over much that I would wish to tell you that I saw and heard in London, and proceed with my visit to Paris, which I reached safely after a troubled crossing over the Channel.

In spite of the recent wars, most cordial relations have speedily returned between scientific men of all countries.

I have met M. Ampère who, stimulated by Oersted's discovery, has extended it and proved that "two parallel and like-directed currents attract each other, while two parallel currents of opposite directions repel each other."

It may be truly said that "the theory and experiment (of electric currents) seem as if they had leaped full-grown and full-armed from the brain of the 'Newton of Electricity.' The theory is perfect in form and unassailable in accuracy, and it is summed up in a formula from which all the phenomena may be deduced and which must always remain the fundamental formula of electrodynamics."[4]

But I must pass on, my dear Mr. McGill, to other branches of natural philosophy. I must name the illustrious M. Chladni, whom they call "the Father of Acoustics." Him Napoleon summoned to show his experiments on sound and gave a grant of money towards the publication of his book. Galilei first experimented with dust on vibrating metal plates struck by a chisel, but Chladni made great

[4] Maxwell.

improvements by using lycopodium dust with sand. He separated thus the quiescent from the turbulent regions, for as Farady has explained, the light lycopodium dust is caught in the whirlwinds of air and finally comes to rest below them, while the heavier sand is driven to the nodes. I have been informed that in the recent wars sand has been placed on a drum and the direction of underground mining has been found by the displacement of the sand on the top of the drum set vibrating by the distant blows on the ground of the picks of the enemy. An ingenious application of Chladni's figures!

Most interesting of all are the speculations about light founded on the most ingenious experiments carried out by Fresnel and Arago. They experiment with "one-sided" or polarized light and secure interference between two rays from the same source polarized in the same plane, which cannot be done when the rays are polarized at right angles. This is strong evidence for the wave theory, but a challenge was given that a small round body like a coin should have a bright spot in the center of its shadow from a small bright source of light. In truth, and it should! And the difficult experiment was triumphantly carried out by M. Fresnel!

Beautiful and interesting experiments have also been carried out by M. Malus on the polarization of light, and splendid color effects have been achieved with the interference of polarized light passing through crystals of mica, gypsum, or quartz.

The simplest interference experiment is to pass light through a slit and hence through two slits close together. On a screen behind you can perceive bright and dark bands alternating which prove that two lights can make darkness, which seems impossible with material things, but is readily explained with waves, for we have all seen, on a lake or pond, crests and troughs of waves cancel one another.

There is great encouragement given to science in these days. Thus the famous Euler received a grant of £20,000 in the last century, and the British Government offered a prize of £20,000 for finding the longitude at sea within thirty miles.

Space has not permitted me to write of Fourier, a great mathematician who has established most fundamental principles of the flow of heat. His work, "Théorie de la Chaleur," has in his own lifetime passed into a classic.

But what shall I say of Laplace, author of "Mécanique Céleste," now seventy years old, comparable only with Newton, who has been honored by all political parties in the turbulent periods passed by France in his long life. A man more admired than loved perchance! Laplace has advanced the theory of tides, explained the origin of the sun and planets from a nebula to its present state, and proved that all bodies of the solar system are stable, and may have been so for periods of vast antiquity.

In the spectrum of the sun, Wollaston (1802) and Fraunhofer (1815) have found a very great number of dark lines which await explanation from succeeding generations. Here indeed we have a great mystery!

But I fear, dear sir, that my letter has far outstripped your patience. Your friends in Glasgow and in Scotland learn with pleasure and interest your scheme for founding a College for the Advancement of Learning in Montreal. Judging from what I have seen in Scotland, in England and in France such an institution may bring lasting lustre to your name, and yield priceless fruit throughout succeeding ages.

Believe me, honored sir,

Your most respectful servant,

ROB ANGUS.

It must be admitted that historically the above letter will be found wanting, for it purports to be written in 1821, by a "fake" professor of Glasgow University, whereas we all know that our founder died in 1813, eight years before McGill received its charter in 1821. I am assured, however, by my colleague, Prof. Cyrus Macmillan, that otherwise my conception of such a letter is a sound one, and that James McGill was truly interested in science as well as letters. He was himself a student or at least a matriculant of Glasgow University, a fact which explains so much. You will recall that he specially enjoined in his will that there should be a Professor of Natural Philosophy, until such time as there should be three chairs established in mathematics, natural philosophy and astronomy.

Today McGill has many professors of physics, a subject now taught to all faculties. McGill has also several professors of mathematics, but no astronomer, although he whom we might ven-

erate as our second founder, I name Sir William Macdonald, donated a splendid region on the summit of Westmount for an observatory, the land being still available, although we cannot hope for "good seeing" within the confines of a city yearly growing blacker with factory and engine smoke, largely preventable and unnecessary.

As for the information conveyed in the fictitious letter, it is gathered mainly from contemporary sources, and the lectures by Dr. Thomas Young, afterward published as a Treatise on Natural Philosophy, are a great mine of information. But a more valuable source is Mrs. Kirstine Meyer's recent essay [5] on the Life of Oersted. For in 1801 Oersted went to Weimar, Berlin, Gottingen and Paris; he saw Ritter's electrical experiments and the very first storage battery, copper plates with damp cardboard between, which retained a charge for some time after it was connected to a battery, capable also of generating a current after being charged.

In 1812 and '13 Oersted again visited Berlin and Paris, and from autumn, 1822, to the summer of 1823 he visited Germany, France and England, although he was full professor of natural philosophy at Copenhagen at the time. I mention this because we see here in the same man the great advantages of three notable institutions or arrangements which I wish to advocate ardently for Canada and elsewhere. For in the case of Oersted we see an able but needy student obtaining free board and residence and a scholarship as well, relieving him of money embarrassments and securing him a sound and liberal education. Secondly, we find him with a traveling fellowship, which enabled him to appreciate the work and progress of many scientific centres. Lastly, we find him with a sabbatical year, relieved from the burden of teaching and academic affairs, and given leisure to think and to investigate. The scholarship, the traveling fellowship, the sabbatical year were all fruitful. As a result Oersted founded electrodynamics, for he proved that a coil of wire with a current round it was the equivalent of a magnet.

This fundamental result, developed by Ampère, Faraday, Maxwell, and many other co-workers, is the seed of the fruitful results or harvest which you see around you today. I refer to

[5] See *Nature*, June 16, 1921.

electric motors, lamps, dynamos, generators, electric irons, cookers, bells, toasters, cleaners, and no less to telephones and telegraphs.

We can rest assured that if you give due encouragement and assistance to your quite ablest boys at schools, and to students and professors at universities there are other and greater conquests of science of which we have little or no conception today, awaiting discovery and development, and that you must not hesitate to encourage pure research, at unpromising subjects even, rather than endeavor too much to secure industrial research on a commercial basis. The pioneer work is truly of the greater importance though less likely to secure the appreciation of manufacturers, of politicians, of practical men and of the public at large.

Here I must interpose a story. About fifteen years ago, one of my predecessors, Professor John Cox, gave a lecture in this theatre on the passage of electricity through rarefied gases combined with some wonderful experiments, all with the skill and eloquence of which he was and is still a master. Now Sir William Macdonald was present and he remarked afterward, "How beautiful and how useless!" Yet it is the study of those very phenomena which has led to most notable recent developments in radiology, for example the Coolidge tube, in long-distance and guided telephone, in wireless telephony and telegraphy, particularly by the use of the electronic valves.

But Sir William appears to have been himself a convert before his death. As donor to McGill of this Macdonald Physics Building, as founder of the two Macdonald chairs of physics, he was present at a lecture given by Sir Ernest Rutherford on some of his recent work on radioactivity, and after the lecture Sir William stated that "if all the money spent on the endowment of physics at McGill had produced no other result but Rutherford's work on radioactivity alone—the money would have been well spent!" That verdict you will all endorse, with a fervent hope that, although we can scarcely expect ever to rival that remarkable outburst at McGill, of a new branch of physics, we may not merely assist in the training of many thousands of young Canadians in the foundations of science, but also hand on the torch of original research and pioneer investigation in this place.

Oersted in 1822 and '23 was not very enthusiastic about German science. "Schweigger, at Halle, has brains, but is a reed

shaken with the wind. His experiments are not of much importance; Kastner, at Erlangen, writes thick volumes compiled with much toil but without all judgment. Yelin, at Munich, makes indifferent experiments and lies much." (Really, really, Yelin, this is too bad!) "But I have found much that was instructive with Fraunhofer, at Munich, so that I have been able to occupy myself with benefit there for about a fortnight." But he writes to his wife from Paris in February, 1823. "My stay here grows more and more interesting to me every day. The acquaintances I have made grow every day more cordial and intimate." He saw Biot, Fresnel, Poillet, Ampère, Arago, Fourier, Dulong and many others; such was the brilliant list of physicists there at work at Paris. He had long discussions with Ampère on his famous theory, still accepted, that magnetism consists of electric currents in the molecules—electron currents or oscillations as we should perhaps say today. Oersted adds, "On the 10th I was at Ampère's by appointment to see his experiments. He had invited not a few—he had three considerable galvanic apparatus ready; his instruments for showing his experiments are very complex; but what happened? Hardly any of his experiments succeeded. He is dreadfully confused and is equally unskilful as an experimenter and as a debater." This report is in strange contrast with the written records of Ampère which Maxwell has described as the work of the "Newton of Electricity," "perfect in form and unassailable in accuracy." Perhaps Ampère had had the best of an argument!

What then has been added in the last hundred years? Well, the answer to that question will depend on whether you are a so-called practical man or a theorist, whether you are most interested in the applications and practical achievements of physics or in the great principles and theories which underlie the theory and from which the practical applications necessarily arise.

The last hundred years have speeded up all human activities. It now takes days for matter to cross the Atlantic instead of weeks, as then; while messages are flashed across almost instantaneously. A hundred miles a day by coach or on horseback was a strenuous journey, a thousand miles a day by rail is today not formidable.

It has been argued with much force by R. A. Freeman in his "Social Decay and Regeneration" that mankind has suffered to a terrible extent by the great access of power which science has

suddenly placed in its hands, and it may well be doubted if society is yet fitted to receive fresh gifts of energy from the hands of science. Moral development and social organization has lagged behind scientific progress. Human nature is stable and ill fitted to adapt itself to changes of the magnitude and variety of the last three generations. The resultant in stability of modern conditions has shown itself to the greatest extent where the attempted assimilation has been most rapid and ill digested. Petrogard stands out as a prominent and inconceivable wreck, through the mirage of a prostrate Russia.

When we turn our attention to the intellectual achievement of physics we see a far more attractive picture. The last hundred years have seen the almost complete development of the science of electricity.

The great principle of the conservation of energy established by the insight of Joule, Kelvin, Helmholtz and others, stands together with the Second Law of Thermodynamics as the main prop of all physical conceptions. The isolation of the electron, the discovery of its properties, experiments with alpha and röntgen rays and immense developments in modern spectroscopy are illuminating a vivid conception of the structure of the atom. The present century is responsible for the new branch of physics, and in this very place Rutherford delved deep and built high in radioactivity, and we are all gathered together at a "veritable shrine," already venerated as such. We are passing to a new outlook where energy becomes dominant, so that not only does matter appear to be energy, but space, linked with time from which it is inseparable, is regarded as a continuum of energy mainly.

Most important of all is our revision of fundamental conceptions on a more comprehensive scale, in accord with the general scheme of the universe of which we are denizens, embraced in the fascinating and far-reaching Principle of Relativity.

Those only who have specialized in modern physics are familiar with the strange elusive problems embraced in the Quantum Theories of Energy.

An atomistic theory of matter is easy to conceive. A corpuscle of electricity, now called an electron, with well-marked properties, electric and magnetic, is not too obscure. But bundles of energy, or quanta, of magnitudes varying with and proportional to the frequency of the propulsive electromagnetic vibrations present formidable obstacles to the human intelligence, and yet some such entities pervade modern research, and are today most fruitful of actual philosophical progress.

I wonder what my successor, lecturing here one hundred years hence, will be saying about relativity and about quanta!

PASTEUR INSTITUTE SCIENTIST ANNOUNCES DISCOVERY OF PARASITIC ULTRAMICROBE FOE OF DISEASE-PRODUCING BACTERIA.*

The discovery of an ultramicrobe, which is a parasite on bacteria, and which may effect a cure of such diseases as dysentery, typhoid fever, hemorrhagic septicemia and bubonic plague has been announced by Dr. F. d'Herelle of the Pasteur Institute of Paris.

This powerful, minute organism will be able to play an important part in control of epidemics, according to Dr. d'Herelle. He has been able to make men, buffaloes and birds resistant to various diseases by simply introducing into them the ultramicrobe which had become accustomed to preying upon the particular bacterium that causes the disease.

All that would be necessary to stop an epidemic of some disease, typhoid for instance, would be to pour into the drinking water supply a very small amount of the proper strain of the ultramicrobe, Dr. d'Herelle declares. This would infect all of the people with the harmless bacteria-dissolving ultramicrobe which will protect them and prevent an epidemic. The ultramicrobe is tasteless and for all animals and man it is absolutely harmless, Dr. d'Herelle has found by experience.

This wonderful parasitic ultramicrobe has been named the "bacteriophage" or bacteria-eater.

*Reprinted from *Science Service*.

Brought to mind by this new discovery is Dean Swift's often-repeated quotation:

So naturalists observe a flea
Has smaller fleas that on him prey,
And these have smaller still to bite 'em,
And so proceed *ad inifinitum.*

Before announcing his work on the bacteriophage, Dr. d'Herelle has made exhaustive researches into the nature of this ultramicrobe which seems to hold the possibilities of revolutionizing ideas in medicine and biology.

Dr. d'Herelle explains the action of the bacteriophage as follows:

Take the case of *bacillus dysentery.* If a sample of the feces of the patient is taken mixed with bouillon, and then passed through a Chamberland filter, all of the microbes visible under the microscope will be retained in the fine pores of the porcelain filter and the filtrate or the liquid that passes through will be clear, will remain so indefinitely and is in appearance sterile. Suppose that a case of dysentery is followed during its course and that such a filtrate is prepared for each of the thirty days of the illness. If thirty tubes of bouillon cultures cloudy with dysentery bacilli were prepared, and if a drop out of each of the thirty filtrates prepared each day were added to the correspondingly numbered cultures, the following would be the result after twelve hours' incubation: Tubes 1 to 6, no change, cloudy with dysentery culture; tubes 7 to 18, perfectly clear; tubes 19 to 30, cloudy like the first six. A strange phenomenon has occurred in tubes 7 to 18 caused by the adding of the drop of filtrate. The bacilli have been dissolved. And at the same time that this dissolving began to take place the patient began to get well, and on the eighteenth day the cure was complete. The presence of the dissolving principle and the cure coincide. This has been found to be the case in other diseases, even those that are not intestinal in character.

And this principle that appears in the filtrate is thousands of times more powerful than the most energetic antiseptic known. A billionth part of a cubic centimeter of filtrate will dissolve a tubeful of dysentery bacilli And unlike a chemical, the bacteriophages will multiply themselves over and over again. A mere trace of the liquid

in the tube of dissolved bacilli will clear up another tube of culture, and if the process is continued a trace from the 999th tube will effectively cause the solution of the 1000th culture.

But in the dissolved culture of bacilli there can be seen no microbes, even if the most powerful optical means are employed. In fact, the bacteriophages are so extremely small that Dr. d'Herelle declares that without a doubt no human eye will ever be able to see them and determine their form even with the aid of any instruments that may be devised in the future. The volume of a bacteriophage is practically equal to that of a molecule of albumin. It is only by diluting a culture of bacteriophages many, many times, then adding a very small amount to a culture of bacilli and counting the spots where dissolving takes place, that the number of the bacteriophage in a given volume could be determined and that its role in nature could be discovered. By this method it was found that there are at least 2,500,000,000 bacteriophages per cubic centimeter.

There is only one species of bacteriophage able to acclimate itself to parasitism on a very large number of species of bacteria. A strain active against one bacteria can be trained in a test tube to become virulent toward a totally different one.

The bacteriophage is, of necessity, a parasite that is not able to develop except by penetrating into the interior of a living bacterium, secreting a bacterial solvent, and then reproducing itself by feeding on the dissolved microbe. It then sends forth the young bacteriophages to prey upon other bacteria.

The normal habitat of the bacteriophage is the intestine and it has been found in the intestinal tracts of healthy animals, both vertebrate and invertebrate. But it can be introduced in the blood as well and act there. Whether the bacteriophages protect the animal or not depends upon whether the strain present is virulent to the particular harmful and invading bacteria. In the case of the dysentery patient it took six days for the bacteriophages to become active. In fact, the history of a case of contagious disease is the reflection of the vicissitudes of the struggle engaged in within the animal or person by the pathogenic bacteria and the ultramicroscopic bacteriophages. But some bacteria, such as those that live in a healthy animal, are able to acquire an immunity to the bacteriophages, Dr. d'Herelle has found.

The bacteriophage is transmitted in the same way as the harm-

ful bacteria and an epidemic ends because all of the people have been infected by the bacteriophage and have become bacteriophage carriers.

Dr. d'Herelle declares that his discoveries are not antagonistic to the fact that the white corpuscles of the blood provide a defense against bacterial disease, but that the bacteriophages act in the case of animals without natural immunity or that acquired by disease or vaccination.

A monograph of the Pasteur Institute now in the process of printing will shortly be issued and will give a detailed scientific account of Dr. d'Herelle's researches on the bacteriophage.

BACTERIALLY TAINTED MONEY.*

During the earlier years of the development of the modern science of bacteriology, the hunt for harmful microbes was a popular laboratory pastime. The readily secured evidence of the widespread distribution of germs—perhaps it should be designated the omnipresence of bacteria—at first disturbed the peace of mind of many persons who now saw the possibilities of disease transmission awaiting them at every turn. Presently, however, it became clearer that not all microörganisms are baneful and that some are at least relatively innocuous; while the varied protective devices of the human organism against the microscopic invaders were being discovered in rapid succession, thus bringing the sense of relief that comes from the contemplation of our factors of safety.

The alleged danger of dirty money passed frequently from person to person in every day life has long furnished a subject for discussion by those who are accustomed to seek unanticipated calamities or who have in mind some project of a prophylactic nature. Not infrequently the latter are actuated by something more than purely philanthropic motives. There is no reason to believe, as might be expected if money in circulation were a menace to health, that those who handle it most frequently are peculiarly subject to disease. There are, of course, employments which represent vocational risks to the employees. Bank tellers and other money

*Reprinted from the *Journ. Amer. Med. Assoc.*

changers are not demonstrably exposed to unusual chances of infection, although the money which they handle is a medium received from all kinds of persons, often without regard to the possibility that it may be a carrier of infection.

There are scientific reasons why metallic coins may actually be destructive to bacteria. The latter are sensitive to small concentrations of the ions of some of the heavy metals. That such bactericidal action is actually exerted by coins seems likely from the studies of Ward and Tanner [1] at the University of Illinois, who found the indicators of pollution used in sanitary investigation entirely absent from coins in current use and examined by them. Thirty-seven of the strains of microörganisms isolated from the coins were spore formers, and probably spores are necessary before the organism may perpetuate itself for any considerable length of time on coins. This, the Illinois bacteriologists assume, may explain why none of the commonly accepted indicators of pollution were found. They are not spore-forming organisms, and consequently are destroyed by the action of the metals. In other words, the coins act to some extent as bactericides. Similar experiments reported in Great Britain, where the ability of coins to spread disease was tested by the use of common pathogenic microörganisms, disclosed that the life of the latter on the coins was very short. It was concluded that coins may be regarded as negligible factors in the transmission of disease.

Ward and Tanner have pointed out that postage stamps have somewhat the same relation to the public that money does, although their constitution is quite different from that of coins. Stamps are used but once and are not handled by so many individuals, although the adhesive applied to them might be a favorable abode for microörganisms for relatively long periods of time. Nevertheless, the menace is not regarded as a threatening one; and in an investigation conducted some years ago with refrence to the question here at issue, pathogenic bacteria were rarely found on stamps.[2]

[1] Charlotte B. Ward and F. W. Tanner, "Bacteria on Subsidiary Coins and Currency," *Am. J. M. Sc.* 162: 585 (Oct.) 1921.

[2] R. A. Keilty, and P. D. McMaster: *Med. Rec.* 90: 153 (July 22) 1916.

NOTES FROM A POPULAR LECTURE ON "PETROLEUM AND ITS PRODUCTS."

By Professor F. R. Stroup, at the Philadelphia College of Pharmacy and Science.

In the light of what is already known and what seems to be in the not very distant "offing," there is the possibility that the Man of the Future,—

Will live, in part at least, on fats made from fatty acids and glycerin made synthetically from petroleum products or fractions;

Will wear clothes dyed with petroleum dyes;

Will lubricate his alimentary tract with heavy petroleum fractions;

Will heal his wounds with petroleum base ointments;

Will not be afflicted with baldness because of the frequent and free use of crude petroleum;

Will walk and ride on roads made in part of petroleum asphalts;

Will ride long distances and have his freight and mail hauled on trains, boats, aeroplanes or dirigible balloons propelled by steam generated by aid of heat from burning petroleum, or by internal combustion engines using petroleum or some of its fractions;

Will travel shorter distances in cars propelled by the power developed by the explosion of mixtures of air and easily volatilized petroleum products; the

Running gears and cylinders lubricated with heavier petroleum products; the exposed portions of the cars

Painted with lampblack made from petroleum, rubbed up in drying oils made synthetically from petroleum and thinned out with petroleum substitutes for turpentine; the

Wheels shod with tires made of rubber made from isoprene made from petroleum;

Will undergo minor surgical operations under anesthesia produced by spraying the parts concerned with light petroleum fractions or easily volatilized synthetic derivatives of them;

Will undergo major operations under anesthesia produced by inhalation of some of these fractions;

Will live in houses heated by burning petroleum, or gas produced therefrom;

On streets lighted by arc lights, the arc of which plays between electrodes made from petroleum carbon;

Will drown his sorrows (when prohibition shall have become a reality) in gasoline "jags";

Will live a mosquitoless life, made possible by the free use of petroleum on all breeding places of the pest;

Will read books, magazines and newspapers printed with inks made of petroleum lampblack or dyes suspended or dissolved in suitable liquids of petroleum origin; with aid of

Lamps either burning petroleum products, or using electricity generated by petroleum propelled and lubricated machinery;

Will wear fine clothes and will sport diamond studded jewelry, purchased with money made in some phase of the petroleum industry; the

Diamonds made synthetically from petroleum carbon;

Will finally die because petroleum and its derivatives will have made his life so easy that his muscles and vital organs will not have had the exercise needed to make them useful or longer necessary;

Will have his mortal remains cremated in a petroleum fired retort; or

Will be consigned to the "bosom of Mother Earth" in a casket made of wood or other absorbent material so saturated with petroleum paraffin or petroleum asphalt as to make it practically free from decay; the final rites being performed

By an "oily-tongued" divine who will forget the vices of the "departed," and, remembering only his virtues, will give his spirit free passage over a petroleum lubricated road to that happy country where petroleum and its products and derivatives are not needed, even for fuel.

NEW REMEDIES

[This Journal will print in this department at regular intervals the several new remedies which are being legitimately introduced to the professions. It will endeavor to confine its attentions to preparations which are really new or are being reintroduced into the materia medica and which bear ethical ear-marks. The general terminology and text arrangement will follow a uniform or accepted style but where possible pharmacopœial arrangement will be attempted.

The presentation of a new remedy in this department does not necessarily vouch for its character, or its ethical qualities but an honest endeavor will be made to exclude articles that savor of quackery or charlatanism.]

AMYLZYME.—An extract containing all of the digestive enzymes of the fresh pancreas of the hog.

Actions and Uses.—Amylzyme has the power to digest starch and protein and to split fats. It is claimed that it is useful in digestive disturbances resulting from a deficiency of pancreatic secretion and that it hastens the digestion of starch.

Dosage.—From 0.13 to 0.26 gm. (2 to 4 grains), three times daily.

Amylzyme is sold only in capsules.

Manufactured by G. W. Carnrick Company, New York. U. S. Patent applied for. No U. S. trade-mark.

Amylzyme capsules, 2 grains.

Amylzyme is a pale yellowish white powder, having the characteristic odor of pancreatin and a faintly saline taste. It is hygroscopic and incompletely soluble in water, forming a turbid solution which is neutral or faintly acid to litmus. In starch digesting power, it is from three to four times more active than pancreatin U. S. P. IX, if tested by the U. S. P. method. According to the method adopted by the Council on Pharmacy and Chemistry (*Journ. of the Amer. Med. Assoc.,* July 11, 1908, p. 140) amylzyme converts from 110.to 130 times its weight of dry starch to a colorless end-point in ten minutes.

BROMIPIN 10 PER CENT.—Brominized Sesame Oil, 10 per cent. A bromine addition product of sesame oil, containing from 9.8 to 11.2 per cent. of bromine in organic combination.

Actions and Uses.—Bromipin, 10 per cent., acts like the inorganic bromides; but, since it yields its bromine more slowly, it is thought to have less tendency to produce brominism. The combination is not broken up in the stomach; but a portion of the bromine is split off as soon as the compound enters the intestine; the remaining compound is readily absorbed, and, as in the case of other fats, it is largely deposited in the tissues where it is slowly split up. Bromipin, 10 per cent. is said to be more lasting in its action than the bromides.

Dosage.—Four cc. (1 fluidrachm), which may be increased in cases of epilepsy to from 8 to 30 cc. (2 to 8 fluidrachms). It may be given in emulsion with peppermint water and syrup, or pure, flavored with oil of peppermint.

Marketed by Merck & Co., New York, under U. S. Patent 774,224 (issued November 8, 1904; expired), by license of Chemical Foundation, Inc., U. S. trade-mark 32,002.

Bromipin 10 per cent. is prepared by action of bromin chlorid to produce the required brominization.

Bromipin 10 per cent. is a yellow oily liquid, having an oleaginous taste.

To 1 cc. of bromipin 10 per cent. and 1 cc. of chloroform add a few drops of phenolphthalein solution. The addition of 0.3 cc. (1 drop) of half-normal sodium hydroxid produces a red color (*limit of acidity*).

Saponify about 3 gm. of Bromipin 10 per cent., accurately weighed, by boiling with 25 cc. of alcohol and 5 gm. of potassium hydroxide in a porcelain dish. Evaporate to dryness on a water bath and incinerate the residue over a gentle flame. Dissolve in water to make exactly 200 cc. and filter. Acidulate 50 cc. of the filtrate in a separator with diluted sulphuric acid; add 20 cc. of carbon tetrachloride and 5 cc. of freshly prepared chlorine water. Shake thoroughly and allow to separate. Repeat this until further additions of chlorine water do not cause the aqueous layer to become yellow. Draw off the carbon tetrachloride solution. Add 10 cc. of carbon tetrachloride, agitate and draw off the solution, uniting it with the

first carbon tetrachloride solution. Repeat the extraction with a further portion of 5 cc. of carbon tetrachloride. Pass the carbon tetrachloride solution through a dry filter into a flask and add potassium iodide solution. Shake thoroughly and titrate the free iodine with tenth-normal sodium thiosulphate. The amount of bromin found is not less than 9.8 per cent. nor more than 11.2 per cent.—(Through *Jour. of the Amer. Med. Assoc.*)

Butyn.—This is a name applied by The Abbott Laboratories, Chicago, to a new local anesthetic, proposed for use in place of cocaine in surface anesthesia in the eye and for anesthesia of other mucous membranes.

Butyn is para-aminobenzoyl-gammadinornalbutylaminoprophol sulphate. It is a white, hygroscopic solid, very soluble in water.

In the accompanying table the efficiency and toxicity of butyn with that of procaine and cocaine are compared.

On the normal human eye, a 0.5 per cent. solution of butyn is less efficient than a 1 per cent. solution of phenacaine (holocaine), but more efficient than a 1 per cent. solution of cocaine or a 1 per cent. solution of eucaine. Butyn solutions are nonirritant.

When injected hypodermically into albino rats, the toxicity of butyn is two and one-half times that of cocaine; but the fatal dose of butyn (injected intravenously into cats) is about equal to that of cocaine. Sublethal doses are more dangerous than those of cocaine.

COMPARATIVE EFFICIENCY AND TOXICITY OF BUTYN, PROCAINE AND COCAINE.

	Efficiency on Motor Nerves.	Efficiency on Sensory Nerve Trunks.	Efficiency on Rabbit's Cornea.	Efficiency on Frog's Skin.	Intra-dermal Wheal Test.	Toxicity for Perfused Turtle Heart.
Cocaine	1	1	1	1	1	1
Procaine	1	½	⅕	⅛	..	½
Butyn	8	2	1	2	2	1

—(Through the *Jour. of the Amer. Med. Assoc.*)

Incitamin or Fischer's Fluid.—In a communication to the *Lancet,* October 29, 1921, page 933, Prof. J. J. Fischer, of Copenhagen, calls attention to a new remedy devised by him for the treatment of slowly healing sores. The preparation is composed of horse serum treated with trypsin and freed from coagulable substances, horse saliva, and carbolic acid (½ per cent.). It is made under his supervision by a firm in Copenhagen, and was originally called Fischer's fluid; more recently the name *Incitamin* has been given to it.

Incitamin is a colorless or slightly yellowish, not quite clear fluid; after standing for some time it deposits a sediment, but this does not affect its properties. It is non-poisonous when used according to directions. Incitamin is applied on a gauze compress, a little larger than the sore itself; this is covered with gutta-percha and kept in place by a dressing which is changed every morning and evening, or oftener if necessary. The preparation is contraindicated when there is idiosyncrasy to carbolic acid.

The use of incitamin is particularly indicated in the case of ulcers: in addition to its stimulant healing power it has a soothing effect which is appreciated by the patient. It is specially suited to ulcerations of a torpid, stagnant nature, such as ulcer of the leg. In syphilitic and tuberculous sores it has little effect. Prof. Fischer describes several cases in which incitamin was used with good effect. A little fuller information as to its composition would, however, be welcome.—(Through *The Prescriber.*)

Tryparsamide, a New Chemo-therapy Product.—It is shown that tryparsamide, the sodium salt of *N*-phenylglycineamide-*p*-arsonic acid, possesses a marked trypanocidal activity in human trypanosomiasis caused by *Tr. gambiense.* Single doses of from 0.5 to 5.0 gm. produced a peripheral sterilization of lymph glands and blood in an average of 6 to 12 hours. The duration of the peripheral sterilization following single doses of 17 to 83 mg. per kilo ranged from 17 to 58 days in patients who ultimately showed a return of trypanosomes to the peripheral blood. In a number of patients, however, treated with single doses of 9 to 68 mg. per kilo, no such relapse was detected during an observation period of from

40 to 111 days. The drug is extremely soluble in water and may be administered intramuscularly as well as intravenously. The immediate trypanocidal action after intramuscular administration was as rapid as that following the intravenous route while the duration of peripheral sterilization was appreciably longer.

Relatively few repeated doses produced in advanced cases a marked and rapid diminution of the cells of the spinal fluid and were associated with definite improvement of mental and nervous symptoms. The occurrence of visual disturbances in certain advanced cases was the only untoward effect detected during the course of the work, and was apparently related to a too frequent administration of the drug. The condition was transitory in the majority of instances and resumption of treatment was not followed by a recurrence of this symptom.

The general beneficial effect of the drug was a noticeable feature of its action in both early and advanced cases as shown by the disappearance of subjective symptoms, by the return of the pulse and temperature to normal limits, by the pronounced improvement of the blood picture, and by well marked gains in weight.—(*Journ. of Exper. Medicine,* Supplement, Dec., 1921.)

SCIENTIFIC AND TECHNICAL ABSTRACTS

MICROCHEMICAL TESTS FOR SACCHARIN AND ITS SALTS. DENIGÈS.—(*Bull. Soc. Pharm. Bordeaux,* 1921, No. 2; *Ann. Chim. anal.,* 1921, 3, 273-275.)—The silver salt of saccharin is produced by treating on a microscope slide less than 1 mgrm. of a soluble salt of saccharin, such as the ammonium salt (*"sucramine"*) or the sodium salt ("sucrose"), with a drop of ammoniacal silver nitrate solution (3 per cent.). The crystals are of characteristic appearance, and serve for the microchemical identification of saccharin salts. Saccharin itself, which is almost insoluble in water, is first dissolved in a drop of ammonia, and the solution evaporated to dryness on the microscope slide. The crystals of saccharin obtained by the treatment of the sodium or ammonium salt with dilute sulphuric acid (10 per cent.), or with concentrated hydrochloric acid, are also of characteristic appearance. The sodium salt of saccharin may be detected by the formation of cubic crystals of sodium chloride produced on acidification with hydrochloric acid, whilst the ammonium salt yields prismatic crystals of hydrogen ammonium tartrate when treated with sodium hydrogen tartrate.—R. G. P.—(Through the *Analyst.*)

IDENTIFICATION OF OUABAIN AND STROPHANTHIN. A. RICAUD.—(*J. Pharm. Chim.,* 1921, [vii], 24, 161-166).—For the identification of these glucosides the following properties serve: Ouabain forms a pure white powder of nacreous appearance, and crystallizes in rectangular plates. It dissolves in 150 parts of water at 15° C., giving an absolutely colorless, transparent solution, which has a slight bitter taste, and gives no lasting froth when shaken. If a few crystals of resorcinol and then a few of ouabain are added to 4 to 5 cc. of concentrated hydrochloric acid in a test-tube, and the latter is heated to 60° to 70° C. in a water-bath for a few moments, no coloration appears. Strophanthin is usually a dirty white or very pale yellow powder, and is amorphous or crystallized in spangles, often arranged radially; 1 part dissolves in 40 to 43 parts of water at 15° C., giving a solution which is not absolutely colorless or

transparent, has a very marked bitter taste, and yields a persistent froth when shaken. When treated with hydrochloric acid and resorcinol, as described above, strophanthin gives a pink coloration.—T. H. P.—(Through the *Analyst.*)

ESTIMATION OF STARCH BY MEANS OF TAKA-DIASTASE. E. HORTON.—(*J. Agric. Science*, 1921, 11, 240-257.)—The results obtained in the estimation of starch in wheat by the use of taka-diastase varied according to the sample and quantity of the enzyme employed. These variations led to an extensive investigation into the action of this enzyme upon pure potato starch. In the method applied, with modifications, the starch, gelatinized in boiling water, was cooled to 38° C., when toluene and the enzyme were added, and the temperature maintained at 38° C. for sixteen to twenty-four hours. After the mixture had been heated to 100° C. for fifteen minutes, sodium fluoride was added, and the solution was cooled, treated with basic lead acetate solution, diluted to definite volume, and filtered. Excess of lead was then removed by the gradual addition of powered sodium carbonate, and, after filtration, the rotatory and reducing powers were determined, and the starch calculated from the dextrose and maltrose found. The purity of the starch employed was ascertained by the use of the same method with malt diastase instead of taka-diastase. The factors studied included the following: Source of enzyme, age of enzyme, age of *Aspergillus oryzæ* culture from which the enzyme was prepared, variation in amount of enzyme used, time of hydrolysis, addition of yeast extract or of malt diastase to the enzyme, and variation in the clarifying agents used. The results obtained varied between 86 and 97.8 per cent. of starch, and, although great differences in the dextrose-maltrose ratio were found, a large proportion of the results was within the limits of 91 and 96 per cent. The conclusion is drawn that the taka-diastase method is unreliable, and test experiments should be made upon pure starch with every sample of enzyme before and during use. It is possible that the discrepancy observed is due to the persistence of dextrin, but this has not been proved.—T. J. W.—(Through the *Analyst.*)

A New Method for Staining Bacterial Flagella.—The formula for the stain is as follows:

Tannic acid	10 Gms.
Aluminium chloride (hydrated)	18 Gms.
Zinc chloride	10 Gms.
Rosaniline hydrochloride	1.5 Gm.
Alcohol (60 per cent.)	40 Cc.

The solids are triturated with the alcohol, 10 cc. of which is first used, and the mass thoroughly mixed; the remainder is stirred in slowly till the mass passes into a viscous solution of a deep red color. The solution, which is stable, is diluted for use with water, when nearly complete precipitation occurs, a small amount remaining in solution. The usual precautions for successful flagella staining must be observed. No fixation is required. One part of the stain, say 0.5 cc., is mixed with four parts of water and allowed to stand for one minute, after which it is filtered directly on to the film and again allowed to stand for one minute, when a slight bronzing is visible on the surface. It is then washed under the tap. The film is now flooded with cold carbol fuchsin for five minutes, dried, and examined in oil, and if satisfactory mounted in balsam or euparal The preparations are permanent.—H. G. Plimmer and S. G. Paine (*Jour. Path. and Bacteriol.*, 1921, 24, 286.—(Through *Pharm. Journ. and Pharm.*)

Stain for Phagocytes.—The following solution is recommended for staining phagocytes and exudates:

Distilled water (neutral)	100 Cc.
Glycerol	20 Cc.
Alcohol (95 per cent.)	20 Cc.
Phenol	2 Cc.

In this is dissolved:

Crystal violet	0.06 Gm.
Pyronin	0.20 Gm.

The stain is ready for use without filtering, and it is stable if protected from sunlight and evaporation. Films are made and allowed

to dry in air without heat or other fixation. Staining takes place in five to ten seconds after which the preparation is washed with distilled water. Any excess of water is mopped up with blotting paper, but the film itself should not be blotted. The cell nuclei are stained violet and the cytoplasm of a uniform delicate lavender, the cell limits being well defined. Bacteria are a deep purple. Erythrocytes appear as pale lavender shadows. Plasma cells and mast cells exhibit a characteristic structure and stain darkly throughout, so that they are easily recognized.—H. B. Cross (*Johns Hopkins Hosp. Bull.*, 1921, 32, 51.—(Through *Med. Sci. Abs. and Rev.*, October, 1921, 61.)

French Olive Oil.—According to the British Consul-General at Marseilles, French Olive Oil is not being exported, and will not again be exported in quantity until it is possible to obtain foreign olive oils or the oil seeds. The olive oil exported from France in the past was rarely, if ever, pure Provence olive oil, but a mixture of French and foreign olive oil, often of olive and oil seed oils, after refining. According to the French law, olive oil may only be applied to pure olive oil, even deodorized olive oil may only be called table oil or frying oil—huile table or huile a frire.

Olive oils from Provence are classified in the following grades: Surfine, Fines, Lampantes (enfers), and Ressences.

"Surfine" and "Fine" olive oils are edible, and the terms apply to the results of the first pressings of the olive. For the "Surfine" the pressing is less than for the "Fine."

The terms "Lampantes" and "Ressences" apply to olive oils which *per se* are inedible, but become so after being refined (deodorized). Lampantes oils are the product of poor quality olives, and Ressences are oils extracted from the pulp after pressing the olive stones by the hot-water process.

The quality of olive oils varies according to the districts in which the olives were grown. The "Huiles d'Olives Surfines" from the Bouches du Rhone, Var, and Alpes Maritimes, are generally of better quality than those from the Gard, Vaucluse, or Drome. The quality is a matter of flavor.

"Fines" and "Surfine" table olive oils are generally contained in chestnut wood barrels of 5 to 600 kilos net contents. Ordinary

olive oils, that is, "Lampantes" or "Industrielles," are contained in used mineral or cottonseed oil drums of about 175 kilos net contents.—(Through the *Austr. Chem. and Drugg.*)

Western Sneezeweed (Helenium Hoopesii) as a Poisonous Plant.—Marsh, C. Dwight, A. B. Clawson, James F. Couch and Hadleigh Marsh.—United States Department of Agriculture Bull. 947: 1-46. 5 Fig., 2 pl. 1921.—The spreading western sneezeweed, Helenium (Dugaldia) hoopesii causes the disease of sheep known as the "spewing sickness" and is also responsible for some cases of cattle poisoning. The poisonous principle, dugaldin, is an easily decomposed, white, amorphous, solid glucosid which forms a sparingly soluble compound with tannic acid. Experiments prove that little can be accomplished in the way of extermination and as yet there is no remedy medicinally. Proper handling of the herds by competent men may prevent most of the losses.—M. S. Dunn.

Production of Organic Compounds by Micro-organisms.—In his presidential address entitled "The Laboratory of the Living Organism," Dr. M. O. Forster, President of the Chemical Section, British Association for the Advancement of Science, pays tribute to the lowly yeast plant and its close relatives, certain bacteria and moulds. Yeast produces glycerol as well as alcohol. *Bacillus macerans* produces acetone and acetic and formic acids. The following organic compounds have also been obtained by the action of microörganisms: Acetaldehyde, dihydroxacetone, butyl alcohol, butyric, oxalic, succine, fumaric, lactic, citric and pyruvic acids. If the proper genus and species of microörganism be chosen and be given the proper food and the proper environment, it will produce the desired organic compound, and will work 24 hours per day. Certain of these microbiological processes are used on a commercial scale, for instance in the manufacture of acetone and butyl alcohol. (*Scientific M.*, 1921, xiii, 301-308.) (Through *Jour. of Frank. Inst.*)—J. S. H.

MEDICAL AND PHARMACEUTICAL NOTES

Chaulmoogra Oil and Leprosy.—The U. S. Public Health Service has felt it necessary to prevent the too optimistic and extravagant claims recently appearing in the newspapers in regard to the curative effects of chaulmoogra oil derivatives on leprosy. While the use of the oil and of its derivatives has resulted in a considerable number of apparent cures, it is as yet too soon to tell whether these will be permanent.

The ethyl esters of chaulmoogra oil, the use of which has largely supplanted the oil itself, constitute a most valuable agent in the treatment of leprosy. In treating young persons and those in the early stages of the disease, the improvement has been rapid and striking; in older persons and older cases it is less so. Of the cases paroled from the leprosy stations in the Hawaiian Islands so far about 8 per cent. have relapsed and returned for treatment. This was to be expected; and on the whole the results have been so favorable as to make treatment of the disease hopeful. But only time can tell.

Depramtent's Discovery May Be Useful In Human Medicine.—The toll exacted from the live-stock industry by internal parasites such as worms is enormous, and because of this drain on the herds and flocks the zoologists of the United States Department of Agriculture keep up an unflagging search for chemicals and treatments that may be used to combat these organisms. Recently they have discovered that a certain chemical once used in medicine as an anesthetic and now used variously as a fire extinguisher, cloth cleaner, insecticide, and solvent for fats and guns, is very effective as a destroyer and expeller of intestinal worms. The name of this chemical is carbon tetrachloride.

The effectiveness of this chemical against certain round worms has been announced by the department, but what may be the most beneficial use has just been brought out by tests on animals infested with hookworms. In the case of sheep the minimum effective dose

has not yet been determined, but all the doses used, from 12 cubic centimeters to 48, in each case given in 2 ounces of castor oil, removed all stomach worms and all hookworms. It has been equally effective for hookworms in dogs and foxes, and has been used with success against some of the various kinds of worms that infest the digestive tract of pigs.

The fact that a species of hookworm also affects man makes this discovery of the efficacy of this chemical against hookworms in various animals of interest to medical men as well as to veterinarians and live-stock growers. Medical men are now trying it out at several places as a possible cure for hookworm disease in man, and it gives promise of success. As a result of the work so far completed, scientists in the Bureau of Animal Industry consider that this drug will prove of special value in the removal of the various kinds of blood-sucking worms in domestic animals.

Crude Vegetable Drugs Need Careful Drying for Market.—Success in drying crude vegetable drugs for the market depends chiefly upon the careful control of temperature and the flow of air, says the United States Department of Agriculture in a new Farmer's Bulletin, No. 1231, Drying Crude Drugs. The application of a few fundamental principles of drying would result in making more marketable a considerable portion of the vegetable drugs that are gathered. The object of drying is to remove sufficient moisture from the product to insure good keeping qualities. It prevents molding, the action of enzymes, and chemical or other changes which are brought about by the presence of excess moisture.

Crude drugs can be dried either in the air or by the means of artificial heat. Burdock roots, for instance, are split and dried in the sun, while certain aromatic drugs, such as sage, peppermint, and wormwood, are perhaps better if dried in the shade without artificial heat. Belladonna, dandelion roots, and green leaf drugs, are among those which are dried with artificial heat.

Drying in the air varies from merely laying the materials out in the sun to shade-drying under elaborate dry-house conditions. The bulletin gives data on the amount of heat and air circulation

necessary for various vegetable roots and herbs, description of two forms of artificial driers for large and small operations, hints on dry house management, and the care of crude drugs. The bulletin may be had free on application to the department.

Picric Acid for Skin Sterilization.—An investigation as to the relative value of various methods of preparation of the skin prior to operation has been carried out by H. W. Hewitt (*Amer. Jour. Obstet. and Gynec.*, April, 1921, p. 672). For each experiment three areas of skin were selected. A scraping was made from each and placed in culture media; these were used as controls. One of the skin areas was then treated with the antiseptic for one minute, a second area for two minutes, and the third for three minutes. All were washed with sterile water to remove any excess of antiseptic. Scrapings were made and placed in culture media. Using fresh skin areas, the tests were repeated five or more times for each fresh antiseptic.

The methods tested included soap and water, alcohol, ether. iodine of various strength in alcohol and in benzene, picric acid 6 per cent. in alcohol, ether applied for three minutes followed by picric solution for the same time. This last method gave by far the best result, the cultures being negative in every case. Iodine in benzene also gave good results. The ether-picric acid sequence has been tested on nearly a thousand patients at Grace Hospital, Detroit, with most satisfactory results. It is simple, cheap, and efficient; it does not injure the skin, and may be used on any part of the body; it does not injure the peritoneal coat of the intestine; it can be easily standardized. The stain may be removed from the skin with a 5 per cent. solution of sodium carbonate or a 25 per cent. solution of ammonia in alcohol.—(Through the *Prescriber.*)

Preparing Colloidal Gold.—Pietravalle has simplified the technic for the colloidal gold used in the Lange test, and states that he was constantly successful with his new method in obtaining a good suspension. He added to 100 cc. of distilled water 1 cc. of a 1 per cent. solution of gold chlorid and 1 cc. of 2 per cent. solution

of potassium carbonate. This was heated over a flame and, as it began to boil, he added 1 cc. of a 0.5 per cent. solution of glucose and continued the boiling. The fluid in about a minute turns violet and in a few seconds the tint becomes a brilliant purple, and it is then removed from the flame.—(Through *Jour. Amer. Med. Assoc.*)

LOBELIA PLANT; ALKALOIDS OF THE ——. I. H. Wieland. Ber., 1921, 54, 1784-1788.—The isolation of two crystalline alkaloids, lobeline and lobelidine, from *Lobelia inflata* of North America is described. The preparation of the former depends on the observation that its hydrochloride can be removed from its aqueous solution by repeated agitation of the latter with chloroform; the final purification is effected by crystallization from alcohol, benzene, or ether. Lobeline, $C_{23}H_{29}O_2N$, crystallises in broad, colorless needles, m. p. 130°—131° C., $[\alpha]^{15}D = -42.85°$ in alcoholic solution. The sulphate, nitrate, bromide, and chloride are placed in order of increasing solubility in water; they are crystalline neutral salts. The base is monacidic. The oxygen atoms appear to be present in ethereal union since the substance does not react with the usual reagents for the ketonic or hydroxy groups and its stability towards alkali indicates the absence of the lactone ring. The methoxy group is not present. The nitrogen atom appears to be in tertiary form. An unusual property is the ready hydrolysis of the alkaloid to acetophenone, but the fate of the remainder of the molecule has not yet been elucidated. Lobelidine, $C_{20}H_{25}O_2N$, small irregular prisms, m. p. 106° C., is isolated from the final ethereal mother liquors obtained during the preparation of lobeline. Its hydrochloride has m. p. 165° C. after darkening at about 160° C.—H. W.—(Through *Jour. Soc. Chem. Ind.*)

NEWS ITEMS AND PERSONAL NOTES

DEVELOP MANUFACTURING PROCESSES.—Since chemistry plays an important part in many manufacturing processes, the Bureau of Chemistry has been authorized by Congress from time to time to study processes used in industries directly or indirectly related to agriculture. Studies are under way to improve methods of tanning and testing leather in order to develop longer lasting leathers and to produce leather better suited for specific purposes. Improvements have been made in methods for the manufacture of rosin and turpentine, as well as in the grading of these products. Questions relating to the manufacture of paper for specific purposes have received attention. Studies have been made of problems involved in the utilization of wool scouring wastes and in the water proofing of fabrics for farm use. Investigations were made of the manufacture of insecticides.

In the work on the manufacture of dyes, emphasis has been placed upon the study of the laws that govern the chemical reactions employed in the dye industry and the determination of the chemical and physical properties of the substances of importance in dye manufacture. As a result of these investigations many processes have been developed that are useful in aiding the maintenance of a dye industry within the United States.

DR. WHELPLEY, RETIRING TREASURER OF THE A. PH. A., SENDS A PARTING MESSAGE.—"For thirteen years, it has been my privilege to collect the dues and care for the funds of the A. Ph. A. This was only a fraction of the sixty-nine years the association has served pharmacy and a mere point in the future of the organization but it has been an important period in my life's activities. Since 1852, the A. Ph. A. has been a 'going concern,' increasing in membership, adding to its finances and enlarging its field of activities. In the A. Ph. A., I have found many of my most valued acquaintances and cherished friends. January 1, 1922, I shall transfer the

official trust to another but my personal interest in the members will continue. I know that, beginning with the New Year, Treasurer E. F. Kelly, of Lombard and Greene Strets, Baltimore, Md., will have from you that whole-hearted co-operation in his work, which you have given me in the past."

New N. A. R. D. President Their Guest.—His friends in the professions of pharmacy and medicine on the evening of December 1, expressed their appreciation of the honor that had come to them through the election of Ambrose Hunsberger, of Philadelphia, to the presidency of the National Association of Retail Druggists at the Denver convention in September last. This expression took the form of a dinner at which Mr. Hunsberger was the honored guest of his fellow members of the Philadelphia Association of Retail Druggists. Prominent physicians, educators, city, State and Federal officials, manufacturers and wholesalers were among the 150 who participated.

BOOK REVIEWS

ARZNEIPFLANZENKULTUR UND KRAUTERHANDEL (Cultivation of Medicinal Plants and Herbs). By Th. Meyer, Apothecary in Colidtz. Third improved edition. Twenty-one figures, vii and 188 pages. Julius Springer, Berlin, 1919.

In this excellent and well written book, Apothecary Meyer treats of the growing, handling and use of the medicinal and spice plants which can be cultivated in Germany. Most of these are also suitable for cultivation in other countries of temperate climes including the United States.

The contents of the text are systematically grouped into an introduction, three chapters and a supplement. The introduction includes thirty-nine pages of valuable data on the significance of medicinal herb trade, profitableness of cultivation, general rules of cultivation, rotation of crops, manuring, harvesting, drying, grinding and storage. The three chapters deal respectively with annual and biennial medicinal plants, perennial medicinal plants and undershrubs and woody medicinal plants. In considering each plant the author gives the Latin scientific name, German synonyms and family and then discusses the regions of growth, characteristics, cultivation and harvesting. In a number of instances the yield in kilos per acre is also stated. The supplement includes eleven pages of tables dealing respectively with the loss on drying of freshly collected drugs and vegetables, flower and seed calendars, and indexes of Latin-German names of plants considered in the chapters of the text.

The information contained in the book is based to a large extent upon personal observations of the author, who for many years has had considerable practical experience in growing medicinal plants and harvesting medicinal products. The style of the author is easy and affords very interesting reading. The illustrations, while few in number, are very clear. Since the literature on drug plant cultivation up to the present has been largely scattered and meagre, when compard with other phases of pharmacognic endeavor, Apothecary Meyer is to be congratulated upon his efforts of successfully marshalling scattered facts and interweaving them with so many of his

own observations. The latter represent valuable additions to the science of pharmacognosy. The book should be quite useful to agriculturists, pharmacists, pharmacognosists, gardeners and students of drug plant cultivation.

HEBER W. YOUNGKEN.

A TEXT BOOK OF PHARMACOGNOSY. HEBER W. YOUNGKEN, PH. M., PH. D. P. Blakiston's Son & Co., Philadelphia; 538 pages, 350 illustrations. Retail price, $6.

The rise of Pharmacognosy as an autonomous subject took place not so long ago, and it has been less than three decades since Tschirch thought it necessary to answer at length the question asked him by sundry of his colleagues,—"What is Pharmacognosy"? Tschirch and Flückiger, to whom this branch of science owes so much, laid broad foundations, claiming for Pharmacognosy much from both botany and chemistry, and no small areas from history, microscopy, specialized agriculture, drug economics and even from folk lore. Others have not seen the subject so broadly in its cultural and social relations, but have expanded various technical adaptations. Wearing, therefore, a coat of many colors it is not strange that Pharmacognosy presents different aspects and has not assumed a generally recognized design such as we expect to see worn by such old and less composite subjects as botany and chemistry.

Those whose task it was to teach Pharmacognosy three decades ago found it difficult to find a text that could be used with satisfaction. Maisch's Organic Materia Medica had many good points—also lacked a good many. It was unutterably dry. Power's translation of Flückiger's Principles of Pharmacognosy was interesting and authoritative as far as it went, but both in arrangement and content was hardly adapted for use as a text in American school work. Since that time, American teachers have undertaken the task of making their own books. The result has been a series of works having a pretty strong family resemblance. American needs have been seen by all authors in much the same light and the books responding to these needs have a strongly marked character. A disposition is clearly seen to break up the synthesis of Tschirch and Flückiger, relegating several phases back to the several subjects

from which they were taken. The essential result has been to narrow and sharpen the definition of Pharmacognosy. Among the subjects thus reduced or eliminated are the chemical, historical and other broadly cultural features on which the "fathers" laid so much stress.

As a result the American is typically a treatise of a very definite character. As to material, it deals not with the plants and plant products that are, or have been, used in medicine, but with those that have official recognition. Little information is included beyond that required for school or State board requirements. Structure is dealt with insofar as it is necessary for purposes of identification and others equally practical. As a result of this elimination of most of the content having other than an immediately practical utility, Pharmacognosy in its American development has shown a tendency toward narrowing and hardening itself until it comes to fill but a portion of the original outline.

In general subject matter and general manner of treatment, Dr. Youngken's Text Book belongs to the American family of pharmacognosies. Here the crude drugs of the Ninth Pharmacopœia and of the National Formulary IV are marshalled, first in list form classified on a morphological basis, then in articles making up the body of the work on the basis of taxonomic relationships of the plants concerned. Since the evolutionary system of Engler and Prantl is here followed, the arrangement of the body of this book expresses this advanced botanical concept.

This emphasis on the scientific must be acceptable to those who would see the broader outlook prevail.

In the articles dealing with the individual products, there is everywhere evidence of condensation. In spite of interesting and informing things that might be said, the text is compressed to the least number of paragraphs. In spite of this evident tendency, however, the author has succeeded in doing much to relieve the book from almost inevitable dryness. Abundant illustrations, most of them good, references to the channels of trade through which these things come to us, and occasional sentences dealing with the ways in which products are obtained or treated in foreign lands, give touches of human interest to pages that of necessity must largely consist of technical characterization. He has watched the attempts to grow drug plants in this country. Had his space permitted, a somewhat

fuller presentation of this phase of the subject would have been interesting. But the reviewer knows that space is valuable and that Pharmacognosy texts are usually uncomfortably ponderous volumes. This trouble Dr. Youngken has well avoided as a result of these and other omissions.

The typographical make up of the book is very pleasing to the eye, the binding is neat and promises to hold the book together for a longer period than most of its type survive. All in all, it may be said that Dr. Youngken and his co-workers have produced a very good book that has been turned by the publishers into an attractive and serviceable volume.

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DRYING CRUDE DRUGS. By G. A. RUSSELL, *Farmers' Bulletin* 1231, U. S. Department of Agriculture. Pages, 16; Figs., 6. Issued November, 1921.

This contribution from the Bureau of Plant Industry will be of interest to all those who are engaged in the collection and handling of crude drugs. Topics considered are: Principles of drying, including exhaustive treatment of the regulation of air flow and of temperature; Methods of drying; drying equipment; drying with artificial heat; and the care of dried crude drugs. This bulletin forms a welcome addition to the series which has been issued from the office of Drug, Poisonous and Oil Plant Investigations. The series comprises descriptions of American crude drugs and the sources from which they may be obtained and should enable any ordinarily intelligent person to collect, identify, and properly prepare for market indigenous medicinal plants.

The druggists throughout the country can render great service to their own industry by encouraging the collection of such drug plants as grow in their neighborhood and for which there is always a market albeit the prices are commonly low.

This bulletin and those which have preceded it should be read by everyone interested in the handling of crude drugs. It may be obtained simply for the asking.

J. F. C.

ORGANIC MEDICINAL CHEMICALS. By M. Barrowcliff, M. B. E., F. I. C., and Francis H. Carr, C. B. E., F. I. C.; 325 pages. Price, $4.00. D. Van Nostrand Company, New York.

This is only one of a series of volumes, edited by Samuel Rideal, D. Sc. Lond., F. I. C., giving a survey of the chemical industries. This particular book takes up the organic medicinal chemicals, both synthetic and natural, and is the work of M. Barrowcliff and Francis H. Carr.

The plan of the book is unique in two respects: First, instead of being arranged in chapters, as is the usual custom, the material is grouped into eleven sections, each grouping being taken up in the manner of a special article or monograph. Second, these groupings have been made, not according to any chemical relationship between compounds, but according to their therapeutic uses.

The eleven sections into which the authors have divided the material are dealt with under the following headings: 1. Narcotics and general anesthetics. 2. Naturally occurring alkaloids and their derivatives. 3. Natural and synthetic local anesthetics. 4. Antipyretics and analgesics. 5. Organic antiseptics and disinfectants. 6. Purgatives. 7. Vaso-constrictors and vaso-dilators. 8. Diuretics and uric acid solvents. 9. Organo-metallic compounds. 10. The digitalis group. 11. Other substances of interest.

The book is one which should appeal to a large class of readers already possessing good text-books. The descriptions are clear and are augmented by a considerable number of illustrations, each throwing light upon some manufacturing process. Structural and graphic formulas are freely used throughout the book showing the steps in the synthesis of chemicals or in order to indicate their properties or to bring out certain relationships that may exist between them. Another helpful feature of the book is found in the use of structural formulas in the balancing of equations.

No attempt is made to deal with all the known synthetic remedies and some of the descriptions are necessarily incomplete. Notwithstanding this the authors have succeeded in presenting a comprehensive survey of this field of industry that a reader can understand without becoming bewildered by a multiplication of details.

To the chemists, pharmacists, physicians and students who are familiar with the large number of important organic medicinal agents, this book should make a special appeal. In dealing with the

industrial phase of these materials, the book is not only of interest, but of practical value.

E. J. HUGHES.

ANLEITUNG ZUM NACHWEIS ZUR TRENNUNG UND BESTIMMUNG DER REINEN UND AUS GLUKOSIDEN (U. S. W.) ERHALTENEN MONOSACCHARIDE UND ALDEHYDSAEUREN.

DIRECTIONS FOR THE IDENTIFICATION, SEPARATION AND QUANTITATIVE DETERMINATION OF PURE MONOSACCHARIDES AND ALDEHYDACIDS, AND ALSO OF MONOSACCHARIDES OBTAINABLE FROM GLUCOSIDES, ETC.

By A. W. van der Haar; 345 pages; 14 illustrations, and 10 tables. Published by Gebruder Borntraeger, Berlin W. 35, Schöneberger Ufer 12.

A very comprehensive and highly technical treatise, containing much original work not previously published.

In the introductory chapter, the author calls attention to the desirability of discontinuing such terms as cerasinose, prunose, scammonose, traganthose, etc., on the ground that these names referred to substances which had been found to be mixtures, and not definite compounds.

Considerable space is given to the description, and to the constants, of the important monosaccharides, and to those of glucoronic and galacturonic acids, which occur as decomposition products of glucosides.

Processes are given for the separation, identification, and the quantitative determinations of arabinose, xylose, rhamnose, fucose, d-glucose, d-mannose, d-fructose, d-galactose, and for the acids mentioned.

The book concludes with complete analyses of the gum of the apricot tree, of the saponin found in wild chestnut, and of the hydrolysis-products of tragacanth gum.

Numerous references to original publications are given in the text.

The book should prove of very great value to all practical chemists engaged in research on carbohydrates, particularly to those who are interested in the glucosides of medicinal plants.

J. W. STURMER.

THE AMERICAN
JOURNAL OF PHARMACY

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EDITORIAL

CLINICAL LABORATORY SERVICE FOR PHYSICIANS.

The editorial which appears herewith is reprinted from the official organ of the American Medical Association because it is our belief that it gives utterance to statements which will not bear a keen analysis without disclosing an unfair attitude of mind in its writer. We do not take it that it reflects the consensus of opinion of the entire medical profession as we know it, but rather that it is the more narrow viewpoint of a limited element of that honorable profession. And it is rather unfortunate that a message such as this should find so potential and powerful a courier as the editorial column of this widely circulated journal.

Clinical laboratories are undoubtedly becoming more common and their fields of service are daily becoming more extensive. Whether this extension is to continue is a matter of doubt, however, since it is quite believable that this hectic day of diagnosing with a test-tube and slide is bound to be sensibly displaced by a return to the saner practice of considering the patient *per se* and using the eye and the mind oftener than the tube and the slide.

However, the clinical laboratory will always have its sphere of usefulness, and it is but natural that proper precautions shall be observed to insure the establishment of only such institutions as shall offer honest, accurate and reasonably priced service. According to this appended editorial this can only be done provided such laboratories are medically managed.

According to our understanding a clinical laboratory can profitably exist only if it gives the proper kind of service. No clinical laboratory, whether controlled by physicians or otherwise, can ever maintain a profitable career unless it observes the most scrupulous

regard to ethics and to honest and correct as well as reasonably priced service. That laboratory which is inaccurate soon falls by the wayside for its patrons promptly lose confidence in it. Consequently it is readily seen that there is no need for a frenzied rush to save this adjunct of medicine from falling into the hands of quacks and charlatans.

Anent the need for limiting this work to physicians only, at least the management commercially or otherwise, we can see no reason why the doctor is better qualified for this than many others.

The actual fact is that it is not lack of time, as stated in this editorial, but rather lack of information and initiative, which prevents the average practitioner from conducting even the most elemental of these clinical tests. "Work which should be done by physicians is being entrusted to incompetent substitutes." This is not often the truth. May we not recall this incident to prove our point? The scene is an army laboratory. A medical lieutenant, who is sponsor for the truth of the tale is looking through the microscope upon a field representing part of a stained smear. He has been informed by the technician (a graduate of a college of pharmacy) that the field shows the spiral organism and its complementary fusiform bacillus of Vincents' angina. Along struts the major, the nominal chief of the laboratory. With military deference the lieutenant under request stands aside while the major glances at the field. The glance is sufficient to give this self-sufficient gentleman proof enough to warrant the opinion that "here we have the treponema pallidum." The technician and the lieutenant are wise enough and experienced enough to hide their humor till another day, and the chief of the laboratory departs satisfied with his day's work. And so it happens frequently, and these experiences are not by and means confined to army laboratories.

"Physicians are responsible to their patients, *i. e.*, the public, for the character of laboratory service supplied. The results of tests and examinations must be accurate; the fees for such tests must be equable."

Of course this is justice, but are these ends to be gained by affording the control of these laboratories to physicians only? Might this altruism not carry the physician into other phases of activities so that no one but physicians remain privileged to dispense drugs, to massage, to manufacture crutches, trusses and such appliances kindred to the doctor's work and necessary for his patients?

The physician of today, referring to the younger men, are avowedly better trained from the laboratory standpoint than their older confreres. But to specialize in this work requires a basic training in science and exactness, in chemistry and physics, in mathematics and in chemical manipulation, far superior even to that which is received by the medical graduate of today. Is it not true that most of our prominent physiologic chemists of the day are not physicians, but scientists trained along entirely different lines, and for that reason more eminently fitted for their respective work? One need only mention Hawk, Dakin, Benedict, and many others. Let us consult the list of authors in the current issue of the JOURNAL OF BACTERIOLOGY, OF GENERAL PHYSIOLOGY, or OF BIOLOGICAL CHEMISTRY, and it is promptly noted that not one-half of the ablest writers are physicians. Nor is it impertinent to recall that the greatest advances in medical history have followed the devices and discoveries of men quite foreign to the profession. Should the world have been denied the marvellous discoveries of the great Pasteur because he was not a physician? No indeed! for to change the whole vista of medicine and surgery "Heaven trained a pure scientist, who had never handled a scalpel nor written a prescription, took this non-medical man of science and set him to be the head of all the heads of the medical profession, to have them all obedient to his teachings and proud of the very sound of his beloved name." That is the story of Pasteur.

The directors of many hospital laboratories in this vicinity are not medical men, but trained chemists and serologists specifically trained in their respective fields and thus privileged to offer the finest kind of service. A casual canvass of the commercial clinical laboratories, extensively patronized by physicians, shows a similar condition and it bespeaks credit to these institutions for their survival is ample proof of their fitness. It also proves our contention that the conduct of these laboratories is not essentially "the function of the organized medical profession."

The editorial to which we refer is herewith appended.

"Laboratory methods now play a large part in the daily work of physicians. Chemical, morphologic, bacteriologic and serologic methods, as well as the roentgen ray, are in daily use everywhere, and new methods, for example, the electrocardiographic determinations and tests of metabolism, are being introduced. To meet the constantly growing needs for such methods, there have come into existence laboratories of health departments and of hospitals, with more or less differentiation into separate departments; also wholly private laboratories. The latter group includes those frequently re-

ferred to as commercial, because dependent on fees, and the individual establishments of physicians working alone or associated in groups. The old-time pathologist, the prototype of the modern laboratory physician, whose function in clinical diagnosis was to determine the nature of lesions from gross and microscopic examination of tissues, has undergone differentiation into clinical chemist, clinical bacteriologist, clinical serologist, clinical microscopist, and roentgenologist, and there has come forth a formerly unknown adjunct to medical practice, the laboratory technician. So rapid has been the evolution of the clinical laboratory and the extension of laboratory methods in all fields of medicine, that frequently fear is voiced lest much work that should be done by physicians is being entrusted to incompetent substitutes.

"Analyzing the situation, we must reckon first with the fact that the great majority of private practitioners for various reasons, lack of time being an important one, are prevented from making any but the simplest routine tests themselves. Therefore they must turn to some one for help, and the privately owned laboratories offer their services. That there has been an increasing demand for this form of laboratory service is evident from the number of laboratories that have sprung up and developed in recent years. Secondly, it appears that we shall be dependent on this kind of laboratory service for some time at least.

"The laboratory features of the proposed health centers or of institutions financed and controlled by the community are attractive to many physicians and are idealistic. They represent a condition in which the same type of service would be rendered to all of the physicians in the community, the cost being reasonable and equally distributed. It might, however, be subject to the charge of representing a further intrusion by the State into medical activities. In any case, the commercial laboratory is an actual fact in our medical practice today. This being the case, the organization, methods and control of such laboratories should receive serious consideration. Physicians are responsible to their patients, *i. e.*, the public, for the character of laboratory service supplied. The results of tests and examinations must be accurate; the fees for such tests must be equable. The conditions in some of these laboratories are such that thoroughly competent and well-trained physicians have been attracted by the work. It is desirable that similar conditions develop in all laboratories, so that well-trained physicians, and not incompetent technicians, become responsible for laboratory service. These things can be achieved only by satisfactory control. Through this control the laboratories will be capable of rendering services of great value to the medical profession, and those institutions not rendering such service may be suppressed. Any effort whereby clinical laboratories are brought up to reasonable and fair standards is to be commended. As to the ideal method of control, there can be no difference of opinion; it should be the function of the organized medical profession."—From the *Journal American Medical Association*, November 5.

I. G.

THE BLESSED PRIVILEGE OF WAITING.

I stood beside a man the other day who stared through the crystal of the book case at the drab green-covered volumes of Barton's Flora. Outside crisp snowflakes played merry tunes on the frozen strands of a winter wind. The earth about glistened with immaculate whiteness, and men preferred to stay close to crackling coals so biting and chill was the weather. The man slowly lifted his gaze

from the flower books and said, "Let us go botanizing, boy," and promptly from the hearts of both of us there rushed a passion that sent blood cells caroming to every peripheral corner. For we two had tasted before the blessed privilege of field communion, and we had walked together in languid happiness through avenues of tall trees skirted with a myriad blossoms. Together we had long since learned that the Lord lingers close by His flowers, and that the open hearted can always find Him there.

But, soliloquizes a reading Thomas, how botanize when the pond where lilies live is locked in rigid iciness, and the murmuring brook whose moist banks kept sweet the violet and the modest gold-cup, runs silently through awkward rifts of sodden snow. The feathered folk have travelled far away to sing their songs to other ears, and only the chirping sparrow and the raucous crow remain behind to pick our crumbs and keep our company. The breezes of evening no longer carry on their wings the fragrance of the honey-suckle, and the warm amours of the pines, but only a chilly crispness and a smell of soot and sulphur.

But the man who saith "Let us go botanizing, boy," is a Man of Hope, and his words came to being so spontaneously that I knew that his eye peered through the mantle of snow and saw a dainty blossom, waiting for its day of unfolding. To him the migrating robin red breast sings only wearily on the mesquite down Mexico way, and it longs and longs and longs to come home with Spring, to be once again the joyous, vigorous song bird of the Philadelphia morning.

He knows full well that the frost on the lily pond will vanish with Spring. He knows that the violet beneath its snow coverlet only sleeps, and that morning will soon come when it will yawn itself into a fragrant existence. He knows also that the breeze of the evening will again carry to his soul the breath of sweet flowers; that the feathered folk who flew away will come again another day, to sing in sweeter tones than ever their God directed melodies.

For it is Faith in a return of the Flowers, Hope for health to live and enjoy them, and Love of Nature and its God-director—Faith, Hope and Love, these three—that makes it possible for this man even in the dismal days of winter to say,

"Boy, let's go out among the flowers."

I. G.

ORIGINAL PAPERS

SODIUM HYDROSULFITE.

By FREDERICK W. HEYL and FRANK E. GREER.*

There exists a voluminous literature [1] concerning derivatives of hydrosulphurous acid ($H_2S_2O_4$) and its reduction product sulfoxylic acid (H_2SO_2), but it is confined almost exclusively to the patent literature. Neither of these is known in the form of the acid. The sodium salt of the former and the sodium salt of formaldehyde sulfoxylic acid ($CH_2OH.OSO\ Na$) are important commercial reducing agents. The preparation and stabilization of these and their varied use in textile printing and dyeing is the subject of several hundred patents.

With the discovery by Ehrlich and Bertheim [2] of the reduction of arsanilic acid to p. amino-phenyl arsenoxid, and to diaminoarsenobenzol by means of sodium hydrosulfite this reagent becomes of interest beyond the textile field. In fact it is a reducing agent capable of very general use, having been successfully employed twenty years ago [3] for the reduction of certain nitrophenols.

Sodium formaldehyde sulfoxylate, aside from its value as a reducing agent, has the power of condensing with aromatic amines [4] to form soluble neutral derivatives of the amines, but at the same time producing marked alteration in the pharmacological nature of the original base, as *e. g.* in neoarsphenamine. This reaction is usually represented as follows:

$$X.NH_2 + HO.CH_2.\ OSO\ Na \rightarrow X.NH\ CH_2OSO\ Na.$$

This condensation of aromatic amines with sodium formaldehyde sulfoxylate gives a product which will not reduce indigo-carmine in

*Holder of The Upjohn Coöperative Fellowship at Kalamazoo College (1920-1921). This paper is based upon the thesis presented by Mr. Greer to the Faculty of Kalamazoo College, in partial fulfillment of the requirements for the degree of Master of Science.

[1] Jellinek, *Das Hydrosulfit*, 2 Vol. (1911).

[2] B. 43, 917 (1910).

[3] Chem. Zent. 1, 1014 (1900).

[4] Reinking, Dehnel, Labhart B. 38, 1069 (1905).

the cold [5], although some reduce indigo in the cold if acid is present. According to Binz and Marx [6] the condensation between the salts of the bases and sodium formaldehyde sulfoxylic acid proceeds in two phases.

(1) R. NH_2HCl + HO CH_2O SO Na → R.NH. CH_2 OSOH.

(2) R. NH. CH_2 OSOH + R. NH_2. HCl → R.$NHCH_2$ $OSONH_3$. R.

There is thus formed an insoluble ammonium salt. In the preparation of neoarsphenamine there is obtained from the reaction mixture small amounts of material insoluble in sodium carbonate. This material probably represents substances of the salt type. (2) In any event the detailed study of this substance requires eminently pure sulfoxylate, and the use of commercial sulfoxylate through the presence of impurities further complicates the study of the reaction.

In the same way the production of arsphenamine requires proportionately large quantities of hydrosulfite for the reduction of 3-nitro-4hydroxyphenylarsinicacid. According to the Ehrlich process, 263 g. would require 3930 g. commercial sodium hydrosulfite (80%)

$$2(NO_2)\ (OH)\ C_6H_3\ As\ O(OH)_2 = 10\ Na_2S_2O_4.$$
$$263 \qquad\qquad\qquad = 870$$

or about 3.6 times the theoretically required amount. It appeared to us that the chemical variability of the product might be due not so much to the arsinic acid, which is prepared analytically pure, but rather to the reagent which is not only impure, containing unknown substances but which is known to react in a secondary manner to produce organic sulphur compounds in variable quantities.[7]

It was therefore desirable to review the patent literature and arrive at a laboratory method for the production of these reagents. The object of this paper is to describe the production of these substances and their properties. We obtained most satisfactory products by first producing crude sulfoxylate by D. R. P. 256, 460. (1913). This was purified by recrystallization. From pure sulf-

[5] Reinking, B., 38, 1074 (1905).
[6] B., 43, 2344 (1910).
[7] *J. Chem. Soc.* 117, 370 (1920).

oxylate, the anhydrous hydrosulfite was prepared by the reaction discovered by Bazlen.[8]

$CH_2OH\ OSONa + 2\ NaHSO_3 \rightarrow Na_2S_2O_4 + HCHO. NaHSO_3.$

The original experiment however leads to the highly unstable crystalline hydrate $Na_2S_2O_4.\ 2H_2\ O$, but by modification to the extent of carrying the reaction out at a temperature of 70° (above the transition point, 52°) the anhydrous salt is precipitated by salting out.[9]

While this is not as economical as the direct production of hydrosulfite by the reaction of bisulfite with zinc, it will be found to be better adapted for the laboratory scale as the product requires no purification whatever, and is free from zinc, and is invariably permanent.

EXPERIMENTAL.

Preparation of Sodium Formaldehyde Sulfoxylate.—This is produced smoothly according to D. R. P. 256, 460, the most essential requirement being violent mechanical agitation. 312 g. $NaHSO_3$ (3 mol.), 257 g. formalin (90 g. CH_2O) are mixed with the addition of 54 cc. water. Water (500 cc.) is used to further dilute the reaction mixture and to moisten the reducing mixture consisting of zinc dust (360 g.) and zinc oxide. (150 g.) This is gradually added in small portions and the reduction mixture is held at 70°. After the addition of the reduction mixture, the reaction is continued for two hours at 100-105°, with violent agitation. The mixture is filtered and the precipitate washed with hot water. This filtrate concentrated to dryness yields the commercial product.

When the filtrate was concentrated to 400 cc. a crop (A) weighing 347 g. separated. This was redissolved in warm water and fractionated, yielding a top fraction of 56 g. which separated from the warm solution. It had a purity of only 6.2%. The next crops; 22 g., 45 g., and 48 g. were pure sulfoxylate (99%). The fifth crop separating from the warm solution weighed 11 g. and was only 24% sulfoxylate. The sixth crop weighed 33 g. and was 74.4% pure.

The filtrates were joined and concentrated and from the warm solution 20 g. of 16% material was removed by filtration. Then 2

[8] B. 38, 1065 (1905).

[9] U. S. P. 990, 457 (1911).

crops of 59 g. and 51 g. separated. The purity of these was 96% and 81% respectively. The yield of sulfoxylate is about 60%.

For laboratory purposes it is somewhat simpler to reduce the addition product of formaldehyde and commercial hydrosulfite.[10]

($NaHSO_2 . CH_2O\ NaHSO_3 . CH_2O$).

The use of zinc and acetic acid as there directed leads to the presence of acetates and renders the subsequent purification by crystallization more difficult. The following is a practical laboratory process: 400 g. hydrosulfite is dissolved in 400 cc. formalin and 300 cc. water. This is reduced with a mixture of zinc dust (300 g.) and zinc oxide (100 g.), first at 70° and then two hours at 100-105° and with agitation. To the liquid a few drops of sodium carbonate solution are added and the filtrate on concentration always yields a crop of almost pure sulfoxylate. By fractionation yields of 70% are obtained.

Calc. for $NaHSO_2 . CH_2O$.C = 10.1 : H = 2.5. Found: C = 9.4, 10.0, H = 2.7, 2.55.

In recrystallizing this substance it is desirable to keep the solutions alkaline with Na_2CO_3 and to have a small amount of formaldehyde present. The temperature is never allowed to exceed 70° at which temperature this substance is exceedingly soluble. (1 liter dissolves 500-600 g.[11]) .Otherwise there is a constant decomposition with the emission of a garlic or mercaptan-like odor.

Analysis of Sodium Formaldehyde Sulfoxylate.—$CH_2OH\ OSO\ Na\ 2H_2O$.

This substance is now procurable in a rather high state of purity (85%) on the American market. It may be analyzed readily by the direct titration of a hot solution (acidified with acetic acid) using standardized methylene blue solution. The titrations were carried out in an atmosphere of CO_2. The solution is warmed gradually during the titration and not boiled until the end point is reached. In a well conducted titration an excess of methylene blue solution is had at all times until almost at the end point. The titration liquid is taken from the flame just as the color is about to vanish, before each new addition of methylene blue. Reduction does not proceed rapidly until a temperature of about 50-60° is attained.

[10] D. R. P. 165. 807.

[11] Osann, B. 38, 2290 (1905).

Baumann, Thesmar and Frossard[12] analyze sodium formaldehyde sulfoxylate by titrating with an ammoniacal copper sulfate solution in a stream of hydrogen at 55°. This method is satisfactory for routine purposes but does not give results quite as high as the methylene blue procedure.

$$\underset{154}{NaHSO_2.\ CH_2O.\ 2\ H_2O} = \underset{2}{2\ H} = \underset{2(249.6)}{2\ CuSO_4\ 5\ H_2O.}$$

it is advisable to prepare an N/4 solution by dissolving 62.4 g. crystalline copper sulfate in water, adding 200 cc. conc. ammonia water, and making the volume to one liter. Then 1 cc. = 0.01925 g. crystalline sulfoxylate. It is our practice to weigh 0.385 g. of the sample, whence each 0.1 cc. of the $CuSO_4$ solution used is equivalent to 0.5% sulfoxylate, and a sample requiring 20 cc. is 100% pure.

When sulfoxylate is titrated with iodine in neutral solutions a quantity of iodine equivalent to four atoms iodine is required. This is an unsatisfactory method for the analysis of crude products as the impurities are likewise oxidized. Baumann, Thesmar and Frossard have made a distinction between sulfoxylate and sodium formaldehyde bisulfite. They showed that while the latter is not oxidized by iodine in neutral solution it may be in alkaline solution. Hence in this common mixture the end point is first recorded for the sulfoxylate in neutral solution, whereupon the partially titrated fluid is rendered alkaline with sodium bicarbonate and a second volume of iodine is slowly required by the bisulfite compound, but the end point is not sharp.

A sample of analytically pure sodium formaldehyde sulfoxylate (calc: H_2O = 23.4. Found, 23.8) was analyzed in the anhydrous state. (Calc: Na, 19.5: S, 27.12. Found: Na, 19.5 S, 26.75).

0.1174 g. required 39.62 cc. iodine (1 cc. = 0.01283 g. I).
0.1500 g. required 18.75 cc. methylene blue sol. (1 cc. = 0.0058 g. Fe).
0.385 g. required 19.4 cc. N/4 copper sulfate sol.

These results correspond to a purity of 100.7, 99.7, and 97% respectively and indicate the fact that in general the copper titration gives slightly low results.

[12] Rev. Gen. Mat. Color 8, 354 (1904).

Solubility of Crystalline Sulfoxylate.—The crystalline product loses its water of crystallization completely when dried in a vacuum over calcium chloride or phosphorous pentoxide. The solubility of the crystalline substance in glycerine was determined.

25 cc. of the saturated solution (18°) weighed 34.2967 g. 5 cc. of this was diluted to 100 cc. and of this 5 cc. was titrated with methylene blue solution. Found: Original 5 cc. = 2.5329 g. sulfoxylate. Therefore 100 cc. of the saturated solution contains 86.5 g. gylcerine plus 50.66 g. sulfoxylate. Therefore 100 cc. glycerine (sp. grav. 1.262) will dissolve about 74 g.

In methyl alcohol the solubility is much lower. 50 cc. of a saturated solution weighs 42.5613 g. By titration 100 cc. contains 8.39 g. sulfoxylate and 76.73 g. methyl alcohol; 100 cc. methyl alcohol (sp. gr. 0.8) will dissolve about 8.8 g. sulfoxylate.

When aqueous solutions of sodium formaldehyde sulfoxylate are treated with barium chloride solutions, either neutral or with one mol. of sodium hydroxide a slight precipitate of the barium salt separates. (3.5% from 5% solutions.) Calcium chloride gives no precipitate in neutral solutions. Both chlorides precipitate sodium sulfite almost completely under the same conditions. Sodium formaldehyde bisulfite is very slightly precipitated by barium chloride, but not by calcium chloride in neutral solutions, but by increasing the alkalinity the baryta forms an insoluble barium salt. Thus in the presence of 0.3 mole sodium hydroxide 67% of the formaldehyde bisulfite was precipitated by barium chloride.

Effect of Sulfoxylate on Rats.—A series of intravenous injections into white rats gave the following results:

Dose milligrams per kilo.	Weight of rat.	Vol. of solution, cc.	Time Seconds.	Result.
400	146	0.58	50	Lived
600	190	1.14	50	"
800	119	0.95	60	"
1000	172	1.72	80	"
1200	93	1.12	65	"
1400	123	1.72	85	"

This chemical is apparently tolerated in very large doses, no disturbance being noted.

Sodium Hydrosulfite.—Analysis of Commercial Samples.

Some time ago a number of samples purchased as hydrosulfite were examined and it was found that some confusion exists concerning this substance. The products consisted in some cases of anhydrous $Na_2S_2O_4$, having a high reducing power on methylene blue, at room temperatures. Other products appeared to consist entirely of sodium formaldehyde sulfoxylate, exhibiting no reducing power under these conditions whilst still other samples had an intermediate reducing power. The last named were either deteriorated products or mixtures.

After studying several methods we finally adopted this method of Knecht and Hibbert[13] for routine work. For this purpose standard solutions of titanous chloride, and of methylene blue are prepared, the former being standardized against ferrous ammonium sulfate.

$$2\ Ti\ Cl_3 = 2\ H = 2\ Fe = Na_2S_2O_4 = C_{16}H_{18}N_3SCl$$
$$2 \times 154.5 = 2 \qquad 112 \qquad 174 \qquad 373.75$$

An approximately one per cent. solution is prepared by diluting 50 cc. of the commercial 20% Ti Cl_3 solution with 50 cc. of conc. hydrochloric acid, boiling and diluting with air-free acidulated water to one liter. This solution is stored under special precautions under hydrogen.

For purposes of standardization 0.7 g. Mohr's salt is dissolved in 25 cc. diluted sulphuric acid, and titrated with a very slight excess of potassium permanganate solution. Into this solution is now run the titanous chloride solution until the ferric salt has been just reduced, using KSCV as an outside indicator.

This titanous chloride solution is only moderately stable. For instance, in one case we found 1 cc. $TiCl_3$ sol. = 0.006 g. Fe (January 10). Later (March 25) 1 cc. = 0.00565 g. Fe.

For the relative standardization 25 cc. of the mythelene blue solution is diluted with about 25 cc. air-free water, acidified with 5 cc. of 25 per cent. acetic acid. The titration is made in an Erlenmeyer flask fitted with a two-holed stopper, one of which is an inlet for a stream of carbon dioxide. We prepared the methylene blue solution so that it will be equivalent to the titanous chloride. It is perhaps advisable to permit a small amount of insoluble material to separate if necessary and to use the supernatent solution. This solution is stable, only an occasional comparison with the standard titanous chloride solution being necessary.

For the analysis of commercial hydrosulfites, since 1 cc. 1% $TiCl_3$ sol. = 0.003625 g. Fe = 0.005631 g. $Na_2S_2O_4$, we usually use for analysis 0.12-0.14 g. anhydrous hydrosulfite if we have 1% titanium chloride solution. This is placed in a dry Erlenmeyer, covered with 25 cc. (an excess) standard methylene

[13] B., 40, 3827 (1907). Knecht and Hibbert, "New Reduction Methods in Volumetric Analysis." Longmans, Green & Co., 1918.

blue solution, all the air is displaced with CO_2 and then the solution is acidified with 5 cc. of 25% acetic acid, and after standing at room temperature a short time the excess of methylene blue, which the $Na_2S_2O_4$ has failed to reduce, is titrated with the titanous chloride solution.

Example: 0.1648 g. sodium hydrosulfite + 24.8[11] cc. standard methylene blue solution, required for decolorization, 9.3 cc. $TiCl_3$ solution. (1 cc. $TiCl_3$ sol. = 0.00588 g. Fe = 0.009135 g. $Na_2S_2O_4$. In a duplicate assay 0.1584 g. required 10 cc. $TiCl_3$. Found, 85.9% and 85.3%.)

The following results were obtained upon commercial samples submitted as "hydrosulfite."

Taken.	Found.	Per Cent. Purity.
0.1200	0.1016	84.7
0.103	0.0809	78.5
0.104	0.0073	6.98
0.107	0.0082	7.17
.102	0.0	0.0
.103	0.0103	10.12
.102	0.0828	81.2
.103	0.0061	5.91

The samples showing low reduction contain formaldehyde and are used for vat indigo dyeing. These should not be listed as hydrosulfites. The reduction of methylene blue was materially increased by raising the temperature, indicating the presence of sodium formaldehyde sulfoxylate.

Purification and Stability of Sodium Hydrosulfite.—We endeavored to ascertain the possibility of increasing the reducing power *i. e.*, increasing the purity. Aqueous solutions are unstable. In order to determine the rate of deterioration, quantities of $Na_2\ S_2O_4$ (85.3%) were weighed into a dry 20 cc. volumetric flask, covered with toluene, 1 cc. of 2N sodium hydroxide solution was added and the solution was brought to the final volume with air-free water. The solution was emptied into a small burette, which had been filled with carbon dioxide, and contained a layer of toluene. This solution was titrated against 10 cc. of a standardized acidified methylene blue solution in an atmosphere of carbon dioxide. 10 cc. methylene blue = 0.0453 g. $Na_2S_2O_4$.

[11] Twenty-five cc. of the solution = 24.8 cc. $TiCl_3$ solution.

$Na_2S_2O_4$ (85.3%) Taken.	Volume.	Solution Used for 10 cc. M.B.	Time.	Loss %
0.1036	20	10.5	At once	—2.3
0.1050	20	10.16	"	—2.6
0.1049	20	10.15	"	—2.3
0.0707	20	15.07	"	—0.3
0.1513	20	7.15	"	—1.8
0.1026	20	10.7	10 min.	—3.2
0.1031	20	10.62	20 "	—.3.0
0.1177	20	9.6	6 hrs.	—6.0
0.1062	20	13.7	22½ "	—27 0
0.1064	20	16.75	16 " (no toluol)	—40

The above solutions were alkaline and a conspicuous break-down is observed after 5 hours.[15] The protection of toluol is an important factor. All of the above titrations were made in acetic acid solutions. The titrations give the same results in neutral or alkaline media, but the solutions are turbid (errors —3.5 and 2.2%). Even when rapidly performed the results obtained fall below those obtained by using an excess of methylene blue solution by 2.5%. For rapid work the method is sufficiently accurate and the titanium chloride solution can be dispensed with. This method is like the original Bernsthen[16] method, using indigo carmine and is quite neat. Knecht & Hibbert point out that this method is not satisfactory for certain commercial samples, since they decompose with the evolution of SO_2 when dissolved in water; they claim furthermore that if alkali is added to preserve the solution that oxidation proceeds so rapidly that within a "few seconds" the results are vitiated As shown above, with careful work the error approximates = 2.5%.

We attempted to purify commercial samples of hydrosulfite as follows: 50 g. high grade hydrosulfite was poured upon 125 cc. air-free water, containing a few cubic centimeters of sodium hydroxide solution at 70° in a current of carbon dioxide or under toluene. The solution was filtered through asbestos in a closed system under carbon dioxide and the filtrate cooled in an ice bath under an inert gas. After crystallization was complete (1 hour), the crystalline hydrosulfite was filtered in a closed system, and mixed upon the alundum

[15] See Lumiere, Lumiere & Seyewetz, *Bull. Soc. Chim.* 33, 931 (1905).

[16] Bernsthen & Drews, B. 13, 2283 (1880), Schützenberger & Risler, *Bull. Soc. Chim.* 19, 152 (1873).

filter with absolute alcohol. The suspension was transferred to a flask containing 300 cc. of alcohol and sodium (15 g.) ethylate, or methylate with mechanical stirring. The dehydrated product was filtered in a closed system and washed [17] with alcohol and ether. The funnel was transferred to a desiccator containing carbon dioxide and dried in vacuo over phosphorous pentoxide. The highest purity obtained was 83.5 per cent., so that practically nothing was gained, although some insoluble sludge is removed by filtering solutions of the commercial product.

This experiment is difficult to manipulate, and even if the preliminary work is successfully conducted, high-grade recrystallized products are prone to decompose upon opening the desiccator. One sample which had been dried for two weeks at 15 to 20 mm., and which assayed over 75 per cent., burst into flame while a sample was being assayed. Some samples showed a tendency to warm up, and were returned to a vacuum in various stages of decomposition.

The ease with which this decomposition proceeds was amply demonstrated in the above-mentioned series of experiments, many of which miscarried. This difficulty certainly justifies the many efforts toward this goal, which are found in the patent literature. D. R. P. 267,872 [18] (1912) directs the mixing of the hydrosulfite with an excess of aniline and evaporation in a vacuum to dryness, with uninterrupted stirring. The object of this procedure is to avoid filtration of the crystalline salt, but the product must of course be impure. In subseqent patents the conditions of the distillation are altered.[19] In other patents [20] evaporations are conducted with alcohol, xylol, hydrocarbons, ammonia, and alkalin substances.

In D. R. P. 280,181, zinc hydrosulfite is mixed with dried sodium acetate, and the mixture is extracted with 94-96 per cent. alcohol, which dissolves the zinc and sodium acetates and leaves a residue of anhydrous sodium hydrosulfite.

Bazlen in his paper on the composition of hydrosulphurous acid, points out the ease with which these alkali salts oxidize, and also how readily thiosulfate is formed even in the absence of air, and he states that drying in a vacuum at ordinary temperature or at more elevated ones in the absence of air leads to decomposition. His method for dehydration consists in placing an alcoholic magma in a Soxhlet and extracting for several hours, using lime in the receiver.[21] He reports an analysis on the pure salt, $Na_2S_2O_4$.

It was with these patents in mind that we attempted the above purification, but the results were such that we were led to attempt purification and preparation through the use of another principle, *i. e.*, salting out the anhydrous form. The temperature above which

[17] U. S. P. 987,170.

[18] U. S. P. 1,156,107 (1915).

[19] D. R. P. 279,389; U. S. P. 1,207,782 (1916).

[20] D. R. P. 213,586, 188,139, 223,260, 207,593; U. S. P. 861,218.

[21] D. R. P. 160,529 (1904).

the anhydrous form cannot exist is 52°. According to D. R. P. 171,991 (1905), one saturates a concentrated solution of sodium hydrosulfite (50-70°) with sodium chloride, or one may warm crystalline sodium hydrosulfite at 50-70° under saturated brine. Thus 2000 volumes concentrated hydrosulfite solution is heated to 50-70° and 510 parts of salt are added with stirring. When the characteristic separation of the anhydrous form is complete, it is filtered in a closed system, using CO_2, washed with alcohol and dried in a vacuum over sulfuric acid. This method is very satisfactory on the laboratory scale, but it does not essentially raise the purity of the commercial material, although the patent claims that 100% material results. This probably depends upon the nature of the impurity in the original material.

Preparation of Sodium Hydrosulfite on Laboratory Scale.—In our last effort to secure analytically pure, anhydrous hydrosulfite we attempted to avoid the impurities originally present in the hydrosulfites, by preparing it from analytically pure sodium formaldehyde sulfoxylate. Bazlen proved that hydrosulfite can be prepared by the interaction of sodium formaldehyde sulfoxylate and sodium bisulfite. He permitted the crystalline form to separate. U. S. P.

$$\begin{array}{c} CH_2OH \\ | \\ OSONa \end{array} + 2 \begin{array}{c} O\text{-}H \\ | \\ OSONa \end{array} \rightarrow \begin{array}{c} OSONa \\ | \\ OSONa \end{array} + H.CHO.NaHSO_3$$

990,457 (1911) combines the principles of this reaction with that of the salting out process as follows: 420 cc. of bisulfite solution containing 208 g. $NaHSO_3$, containing no free sulfurous acid are heated to 60°; 140 g. salt are introduced and the temperature raised to about 65°. In a second vessel a concentrated solution of 118 g. sodium formaldehyde sulfoxylate (230 cc.) is heated to 65°. The contents of both vessels are mixed as rapidly as possible. There is a rise of about 8° and a heavy precipitate of anhydrous hydrosulfite separates. We filtered this off in a closed system under CO_2 washed with alcohol, ether, and immediately placed the product in a CO_2 desiccator and dried at 15-20 mm. The purity claimed for this product, *i. e.*, "an amount of the salt containing one gram of sulfur reduces 4 g. of indigo" is equivalent to a 97.7% purity.

Our yields on small scale experiments in the quantities above outlined give yields of 55 to 60% of theory, and a purity of 80-85%. The product is stable when kept in tightly stoppered containers. Larger scale production would probably result in higher purity.

Toxicity of Sodium Hydrosulfite.—The failure to obtain products by the above process having a purity of at least 95% is a matter of considerable surprise. In the presence of air the damp salt oxidizes as follows:

$$Na_2S_2O_4 + O \rightarrow Na_2S_2O_5 \rightarrow Na_2SO_3 + SO_2$$
$$Na_2S_2O_4 + O + H_2O \rightarrow 2\ NaHSO_3$$

In the absence of air it is said to decompose forming pyrosulfurous and thiosulfuric acids. We have never observed any con-

$$2\ Na_2S_2O_4 \rightarrow Na_2S_2O_3 + Na_2S_2O_5$$

spicuous alteration in well made samples. It is however a fact that the oxidation products of the dry substance are quite as toxic as the hydrosulfite itself.

The following results were obtained: A preparation having a purity of about 83% was dissolved in water and quantities amounting to 150, 180, 210 mg. per kilo proved not fatal, and no effects were observed. With a dose of 240 mg. per kilo death ensued in five minutes.

A second sample having approximately the same purity (83.5%) gave the following results: The rats lived at doses of 100 and 125 mg. per kilo, but at 150 mg. per kilo, death ensued in 7 minutes.

A few similar tests were made upon some of the partially decomposed samples that were obtained when it was attempted to dehydrate the crystalline product with sodium ethylate. The toxicity is not proportional to its reducing activity as is shown by the following results. A badly decomposed sample, analyzing 28% failed to kill in doses of 50, 100 and 150 mg. per kilo, but at 200 mg. per kilo death took place in four minutes, and 10 minutes respectively. This sample is almost as toxic as the above mentioned 83% material.

A sample which had run down to 65% in the desiccator over P_2O_5, suddenly evolved clouds of SO_2 when the desiccator was opened. The analysis showed only 14% (reducing power). When this was injected the rats lived at 200, 300, 325 mg. per kilo, but were killed at 350 mg. (4 minutes).

From the above tests it will be observed that the dry decomposition does not proceed simply from a toxic to a nontoxic substance, nor, is the physiological test, a method for determining the degree of decomposition.

Small doses (25-50 mgs. per kilo) of sodium hydrosulfite injected intravenously into white rats produce no reaction. As the dose (100 mgs. per kilo) is increased the rat shows signs of labored breathing within a few seconds of the beginning of the injection. This quickly wears off and usually within five or ten minutes the rat is apparently normal. Still higher doses (150 mgs. per kilo) produce a more labored breathing with evidence of suffocation. When the maximum sub-lethal dose is reached the rat shows symptoms immediately. Dyspnea becomes acute and the rat doubles up with convulsions within three to five minutes. After eight or ten minutes it has completely recovered and moves about normally. There are no delayed symptoms in rats which survive the injection. The toxic dose produces the same immediate symptoms which rapidly progress in intenisty until death which usually occurs within five to ten minutes.

We wish to acknowledge the biological assistance of Mr. Payne.

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THE EVOLUTION OF CHEMICAL TERMINOLOGY.
I. COAGULATION.

BY JAMES F. COUCH.

In attempting to define with exactness many of the terms in common use at the present time it is often found that there is considerable latitude of meaning covered by the word or phrase. In many cases the limits set about the proper application of a term are vague and may permit its usage in contradictory senses. Such indefiniteness, foreign to the modern scientific spirit, leads often to indiscriminate use of the term and clutters up the literature with much that is sloppy and too much that is not only misleading but positively erroneous. Unfortunately a great deal of this vagueness cannot be remedied as yet for it proceeds from an insufficient knowl-

edge of the phenomena with which the term is associated or results from the applying of the term to a broad field which contains within itself confusing and contradictory elements.

In other cases it happens that a term still in common use was applied generations ago to some type of phenomena which were imperfectly understood. With this as a foundation newly discovered facts were classified by more or less empirical methods according to analogy until the term is now made to represent things which in principle are widely different. Again, because of a lack of knowledge of the mechanism of natural processes two facts which depend essentially on the same fundamental generality have been classified under different names because of some superficial difference in nature.

Another and a fruitful cause of confusion has been the use of specific terms in literature where the exigencies of rhetoric, of the avoidance of repetition, and the difficulties of conveying ideas, not to mention the foot-rule of versification, outweigh considerations of narrow exactitude in the choice of words. We read, for instance, that a large population was coagulated in London; we might, with equal propriety, refer today to the "gelated traffic" at our busy street crossings.

It is possible, however, to remedy a large part of the existing indefiniteness in the use of chemical terms; indeed, it is a simple matter. It requires only an agreement among those who employ the terms to limit certain expressions to certain specific meanings. With this very desirable end in view I purpose to consider in this, and in other communications which are in course of preparation, a number of loosely defined terms, to discuss the manner in which they are now used, to present any objections to this usage, and finally to propose whatever action appears to me best to eliminate the undesirable features.

What is coagulation? In referring to such authorities as the writers of text books, particularly those that deal with physiological and colloid chemistry, we find that while frequent mention of the process of coagulation is made and while it is often exhaustively discussed, the authors studiously avoid defining the term. One must dissect and analyze the whole matter presented by the author before his idea of the process may be determined. We turn then to the standard dictionaries of our language.

Webster's[1] presents this definition: "Coagulate[2] . . . To effect the coagulation of; curdle; clot; congeal; . . . ."

James A. H. Murray[3] defines "coagulate" thus: "1. To convert (certain fluids, as blood, milk, albumen, etc.) into a soft solid mass, as by chemical action, heat, exposure to air, etc.; to curdle, clot, congeal. 2. To form (anything plastic) into a solidified cake or mass; to form as a mass."

Funk and Wagnall's[4] says: "Coagulate . . . To change (a liquid, as blood or milk) into a clot or a jelly, as by heat, by chemical action, or by a ferment; curdle; congeal."

The Century[5] defines "coagulate" as follows: "To curdle; congeal; clot; change from a fluid into a curd-like or thickened mass . . . ."

Gould[6] defines "coagulation" as "The formation of a coagulum or clot" and Dorland[7] as "1. The process of changing into a clot or of being changed into a clot. 2. A clot."

Wo. Ostwald[8] offers this: "Unter Koagulationsvorgängen disperser, im speziellen kolloider Systeme verstehen wir weitgehende Veringerungen des Dispersitätsgrades der dispersen Phase, verbunden mit einem Aufgeben der Homogenität der räumlichen Verteilung."

The generally accepted idea of the term coagulation then is this: It is a process which results in the separation from a liquid system of a non-rigid solid mass or the conversion of a liquid into such a mass. This definition is faulty in that it is too inclusive; it

[1] *New International Dictionary of the English Language*, 1919, p. 424.

[2] In some dictionaries the definition is given under the word "coagulation," in others it is given under "coagulate," and the derivative terms are referred to the form defined. I shall here make no distinction in quoting the lexicographers.

[3] *A New English Dictionary on Historical Principles*, 1898, Vol. 2, p. 548.

[4] *New Standard Dictionary of the English Language*, 1913, p. 508.

[5] *The Century Dictionary and Cyclopedia*, Vol. 2, p. 1067, 1911.

[6] *An Illustrated Dictionary of Medicine, Biology and Allied Sciences*, p. 305.

[7] *The American Illustrated Medical Dictionary*, 1916, p. 230.

[8] *Grundriss der Kolloidchemie*, 1910, p. 446. This definition may be freely translated: "By the process of coagulation of substances dispersed in colloidal systems we understand a far-reaching diminution of the degree of dispersity of the disperse phase accompanied by a giving up of the homogeneity of spatial distribution."

must be modified to distinguish between coagulation and such processes as flocculation, gelation, precipitation, congellation.

In the first place coagulation is a colloidal phenomenon. Albumen solutions, blood, milk, the latex of Ficus elastica, are all colloidal systems. By limiting coagulation to colloids we remove from consideration many similar phenomena which may, under appropriate conditions, occur in true solutions. The precipitation of aluminium hydroxide by ammonia may give rise to a semi-solid mass which superficially resembles a coagulum. A characteristic of coagulation which readily distinguishes it from the process of gelation is that it involves a separation of the disperse from the continuous phase of the colloidal solution: in gelation there is no such complete and sharp separation although it is true that the gel may lose its sorbed solvent by evaporation, in the course of time.

When we consider the question of the reversibility of coagulation processes, however, we discover no general agreement. While the common instances of coagulation (in albumen solutions, blood-clotting, etc.) are clearly irreversible there is a large number of instances which are, by some authors, included in the general class of coagulations and which are known to be reversible. Bechhold [9] considers coagulation as irreversible but prefers to use the term "flocculation" for most colloidal separations. Analysis of his discussion of these phenomena leads to the following conclusion: Flocculation is an electrical phenomenon; it is irreversible; it consists in the precipitation of hydrophobe colloids by electrolytes. The system, therefore, cannot be flocculated unless it contains an hydrophobe colloid. He distinguishes reversible separations of dispersed phases and their continuous phases by the term "salting out." Bancroft,[10] on the contrary, uses the term coagulation in the broader sense; *e. g.,* he says (p. 221), "When albumin is precipitated by sodium chloride, the coagulation is ordinarily reversible. When it is precipitated by the salt of a heavy metal, the coagulation is irreversible." Consequently there is no agreement as to the reversibility of coagulation; each author determines this question by the extensiveness of his application of the term.

Without attempting to analyze the whole mass of accumulated

[9] "Colloids in Biology and Medicine." Trans. J. G. M. Bullowa, 1919, p. 82.

[10] "Applied Colloid Chemistry," 1921, p. 212, *et seq.*

data it may be said that there are three general methods by which the separation of the phases in a colloidal system may be effected: 1. By alteration of the chemical nature of the disperse phase; 2. by altering the physical structure of the disperse phase; and 3. by altering the electrical equilibrium of the system or of the disperse phase. These are three very distinct processes and depend upon widely different mechanisms. Almost the only similarity is to be found in the end result and even here great differences occur. We know that in the heat-coagulation of albumins there is definite chemical alteration of the molecule; in the clotting process of blood a new substance, fibrin, which is not a factor of the initial system appears, formed from one of the constituents of the normal blood. Neither of these processes is reversible. In the curdling of milk, however, which is the third common instance of coagulation, the case is different. In the souring of milk or following the addition of rennin, the casein separates from the liquid mixture. Note that the curdling which follows souring,—or the increase of hydrogen ion concentration,—is a true precipitation for it is due to the decomposition of calcium caseinate with the liberation of insoluble casein and is strictly analogous to the precipitation of salicylic acid from an aqueous solution of sodium salicylate upon the addition of a stronger acid. It is not true coagulation. The action of rennin, on the contrary, produces curdling by altering the casein and the process is not reversible. Consequently, in all three cases of coagulation which are common phenomena and from which our ideas of coagulation are primarily drawn, we have instances of irreversible changes.

Coagulation may be readily distinguished from congelation as the latter term includes any solidification without regard to its nature or the mechanism by which it is produced. The "setting" of wet plaster of Paris or of concrete mixtures are congelations. In the term precipitate we have a general name which includes all instances in which a solid or semi-solid substance, either in an integral mass or in a finely divided state, separates from a liquid. Coagulation is therefore a special case of precipitation. Flocculation may be considered a process in which the degree of dispersity of a colloid in suspension is diminished although this term itself is not narrowly defined and has been used in different senses.

Enough evidence has now been presented, I think, to show the necessity for the adoption of a convention in order to define these

terms satisfactorily. We are forced arbitrarily to exclude certain ideas now associated with the terms and to restrict the assigned meanings to limits which will sharply distinguish the different terms. It is therefore recommended that coagulation be defined:

> An irreversible process of colloid chemistry; it consists of the complete or partial separation of the disperse from the continuous phase as the result of the chemical alteration of the system. The altered disperse phase is precipitated as a non-rigid, insoluble, solid mass.

and that flocculation be considered:

> A process of colloid chemistry in which the complete or partial separation of the phases is effected through an alteration of the physical condition of the disperse phase, either by a diminishing of its degree of dispersion or by a modifying of the electrical equilibrium of the system.

The analysis suggests the usefulness of two new terms; collyte, a name for any disperse phase, and collysis, a general term to indicate any separation of the two (or more) phases in a colloidal solution.

COMMERCIAL GLUCOSE AS A PREVENTIVE OF AUTOMOBILE RADIATOR FREEZING.

By Charles H. LaWall.

The drug, chemical and trade journals frequently contain articles giving formulas for anti-freezing mixtures for automobile radiators. These formulas usually contain denatured, or wood, alcohol, glycerin, or some chemical salt such as calcium chloride.

For four winters past I have successfully employed commercial glucose with unquestioned efficacy and with no detrimental results whatever. The ordinary confectioners' white glucose is preferred, although I have on one occasion employed the glucose sold for table use.

The amount necessary is between 15 and 20 per cent. or about a pint and a half of glucose to a gallon of water. The glucose may be mixed with enough warm water to completely dissolve it and then added to the remainder of the water in the radiator. No further addition or attention is necessary except to replace the water lost by evaporation. When warm weather arrives the radiator should be emptied, rinsed out and filled up with plain water.

In addition to using the mixture practically for four years with satisfactory results I also performed some experiments to determine the congealing point of such a mixture. I found that it begins to get slushy at about 10° above zero F., but that it does not actually freeze and harden even at 6° below zero F.

Glucose does not corrode nor affect metals; in fact, it prevents such action by virtue of its chemical reducing properties. It seems to have no effect upon rubber in the dilution used; at least, I have never had to replace my rubber hose connections. There are no objections to glucose at all that I have found and its inexpensiveness and the freedom from the annoyance of constantly having to replace a volatile solvent such as alcohol, are unquestioned advantages.

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A REPORT ON THE ZAMIA STARCH SITUATION.*

By Joseph F. Clevenger.

One region in Florida where the Zamia plant, *Zamia floridana* DC., grows was visited, and a number of the plants were dug up and examined. In addition, the only mill manufacturing starch from the plant was visited. The following information was collected:

Description of Plant.—Zamia is a small diœcious plant, with a crown of leaves producing on different individuals pistillate (Pl. I, A) and staminate (Pl. I, B) strobili (cones). This is characteristic of the Cycadaceæ to which family the plant belongs. The seeds (Pl. I, D), which are developed in the pistillate strobili, are somewhat oval, measuring approximately one-half inch in length. The cross section shows a triangular outline, a relatively thin, hard seed coat, and a starchy endosperm. When the seeds are mature the pistillate strobili disintegrate and the seeds may frequently be observed in large numbers near the base of the crown of leaves. The plant has an enlarged tuberous-like stem (rhizome) which grows below the level of the ground. This habit of the plant enables it to withstand the frequent fires to which the region where

*Presented at the Sixty-ninth Annual Meeting of the American Pharmaceutical Association, New Orleans, La., September 6-11, 1921.

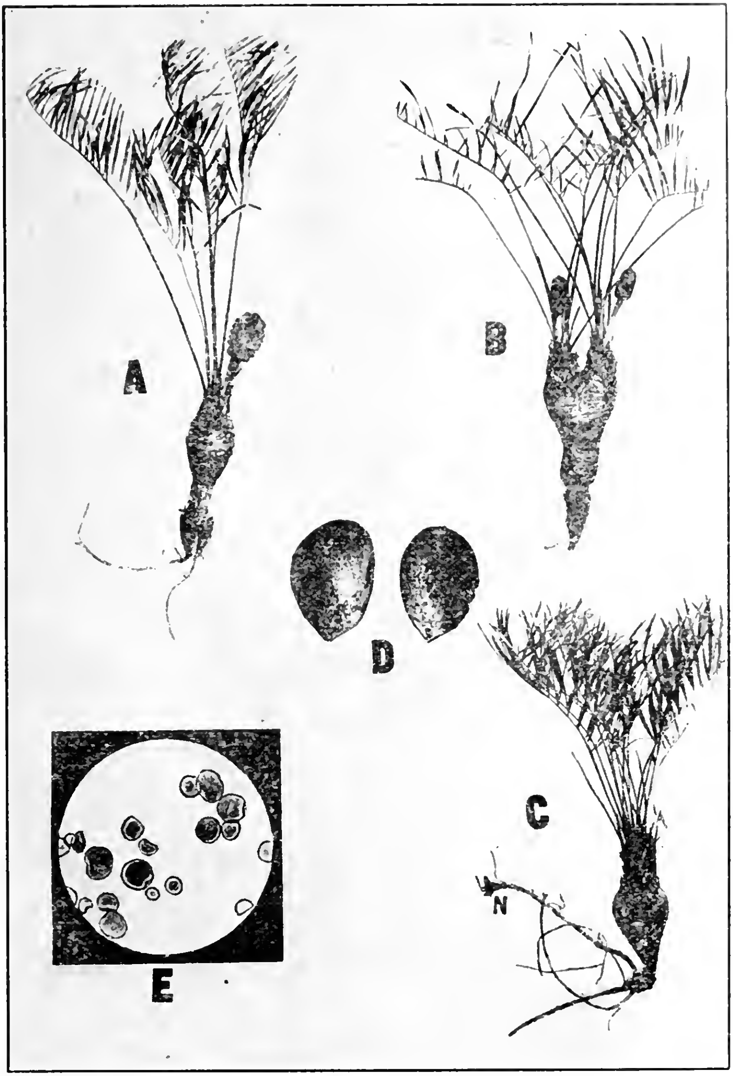

PLATE 1—ZAMIA FLORIDANA DC.

A. Female plant showing tuberous-like rhizomes, crown of leaves and a pistilate strobilus (cone). Approximately X 1/8.
B. Plant showing staminate strobili (cones). Approximately X 1/8.
C. Plant showing root tubercles. N. Approximately X 1/8.
D. Seed. Approximately natural size.
E. Starch grains. Approximately X 140.

it grows is subjected. It is of interest that numerous root tubercles, presumably collecting nitrogen from the atmosphere, as do the nodules of the Leguminoseæ, occur on the roots of this plant.[1] (See Pl. I, Cn.) These tuberous-like stems contain large amounts of starch.

The starch grains (Pl. I, E) are simple, with the exception of a few compound grains of few components. The single grains are spherical ovoid and dome-shaped, and vary in size from 6 to 40 microns in the longer axis. The majority of them vary from 16 to 32 microns in the longer axis.

Analysis of Rhizome.—The following analysis of the plant on an air-dried basis, made in the Cattle Food and Grain Investigation Laboratory, Miscellaneous Division, Bureau of Chemistry, may be of interest:

Moisture	7.73%
Ash	5.01%
Ether extract	0.63%
Protein (N x 6.25)	6.17%
Crude fiber	9.23%
Nitrogen-free extraction	71.23%
	100.00%
Starch (diastase method)	37.75%
Ash insoluble in 10% HCl	0.90%

Of further interest in this connection is the report by Gifford[2] that water which has been used in washing the starch, when drunk by animals, produces slow poisoning. The character of this poison is not known.

Growing Region of the Plant in Florida.—The region where the plant is collected for manufacturing purposes is restricted to a limited area in the vicinity of Miami, Florida, although it grows in the pine lands throughout the southern part of the state.[3] This area

[1] Karl F. Kellerman, "Nitrogen-gathering Plants." *U. S. Department of Agriculture Yearbook*, 1910, pp. 213-218.

[2] John Gifford, "The Everglades and Southern Florida," 2d Ed., 1912, p. 173.

[3] Winifred Kimball, "Reminiscences of Alvan Wentworth Chapman." *J. New York Botanical Garden*, 22, 13, 1921.

does not extend appreciably south of Miami and not much north of Dania, nor in the regions which are subject to overflow. The total area in which this form grows may be roughly estimated to cover about 150 square miles. The area, however, in which the plant may be profitably collected is rapidly diminishing on account of the rapid growth of the city of Miami and its suburbs. The occurrence of a closely related form farther north in the central part of the state is reported, but it does not appear to be used as a source of starch.

Cultivation of the Plant.—Zamia has not been cultivated on a commercial scale. Attempts made in California to grow this plant from the seed were apparently unsuccessful, possibly due to the absence in the soil of the organisms forming the tubercles.

Supply of Rhizomes.—The manufacturer depends for his supply chiefly upon collections by the local residents, who are employed to dig up these rhizomes. It is stated that the same region may be profitably worked over once each five years.

Preparation of the Starch.—The method used in preparing this starch is similar to that used for other starches. The undried rhizome, when ground and mixed with water, is passed over a fine screen to separate the main portion of the vegetable tissues from the starch. The product is then run into settling tanks, where a further separation is obtained. After the starch has settled it is drawn off and dried. The whole operation requires approximately three days.

Use of the Starch.—The starch (Pl. I, E) is used by natives as a food, and, in limited amounts in making crackers, biscuits, and other food products requiring starch.

Present Status of the Industry.—While the mill under normal conditions is reported to have a capacity of about 24,000 pounds per week, or about 750,000 pounds per year, it has been idle since September, 1920.* It is uncertain when this mill will be in operation again. The manager contemplates, when circumstances per-

*Mill visited on January 15, 1921.

mit, to manufacture starch from Zamia rhizomes and also to ship Maranta roots from the West Indies with the idea of preparing starch from them.

Analytical data, such as the tincture power of different reagents, optical properties, and temperature of gelatinization, determined by Reichert [4] for both Maranta and Zamia starch, have been partly checked by the writer. Although useful as a means for differentiation, these data have little or no value as a means to determine the relative value of the starches. The author has been unable to find any definite information regarding the value of Zamia starch as compared with other starches. It is claimed by the manufacturer, as indicated on the label of the carton of his package product, that "you do not get that starchy taste by using Florida Arrowroot."

Designation of the Product.—Zamia starch has been marketed under the designation "Florida Arrowroot." True arrowroot starch is obtained from Maranta root. This double use of the term arrowroot has led to confusion in the trade, which will become greater if Maranta starch is manufactured in Florida, as now seems possible. It is of interest that *Maranta arundinacea,* the plant yielding the product generally referred to as arrowroot starch, is cultivated to a limited extent in some localities in southern Florida.

The names "Koonti," "Coontie," or "Comptie," used by the Seminoles, refer not only to the Zamia plant and its products, but have the general significance of the word "bread," "grits," or "grub." [5] Since differences in the spelling as well as in the pronunciation of these terms also occur, it is evident that none of them would be a well chosen name. The names "Florida arrowroot starch" or "Florida arrowroot flour" should not be used for the reasons already given. The designation "flour" is distinctly objectionable, since during the process of manufacture tissue elements are practically eliminated.

In conclusion, the specific name Zamia starch should be applied only to the product obtained from Zamia plants.

[4] E. T. Reichert, "Differentiation and Specificity of Starches in Relation to Genera, etc." 1913.

[5] Clay MacCauley, "Seminole Indians of Florida," Fifth Annual Report Bureau of Ethnology, 1883-1884, p. 513. Gifford (*loc. cit.*), p. 170.

NOTE: After completion of the manuscript, an article by J. K. Small appeared in the *Journal of the New York Botanical Garden*, Vol. 22, pages 121 to 137, 1921. It is entitled "Seminole Bread.—The conti; a History of the Genus Zamia in Florida." The reader will find here interesting additional information on the subject of Zamia and its products.

PHARMACOGNOSY LABORATORY.
BUREAU OF CHEMISTRY.
U. S. DEPT. AGRICULTURE.

THE TENTH REVISION OF THE UNITED STATES PHARMACOPŒIA.*

By E. FULLERTON COOK, *Chairman.*

I am indebted to the officers of this representative association of pharmacists for the opportunity to present a review of the current Pharmacopœial revision, well knowing that to speak before the New York branch means to secure a national audience.

I also welcome the opportunity at this time to obtain the reaction when important decisions of the committee are made public.

The Pharmacopœia is not established to further the interest of any individual or group, but to do its part to maintain the public health through the activities of the medical and pharmaceutical professions. Its standards should receive the approval of enlightened public opinion when expressed by those qualified to judge.

Therefore a public forum, where there are gathered those who are struggling against disease, is a fitting place to announce and discuss proposed scope and standards.

There are of necessity limitations to the publicity concerning committee work, since it would be manifestly unfair to predict the decision on questions which are yet under discussion but, where conclusions have been reached, the policy of the revision calls for public announcement and comment.

*Read before the New York Branch of the American Pharmaceutical Association, November, 1921.

Organization.—The organization of the committee is so well known through various articles published in recent years, that little need be said of this.

The *General Committee,* made up of all regularly elected members, is the group by which questions of policy and general principles are discussed and decided. For the detailed, scientific study and revision of texts the *Sub-committee Groups* have been organized and here the specialists have full opportunity to use their training and experience that the new text may express the last scientific fact and the accepted standards and tests.

A new feature of the Tenth Revision has been the addition of *auxiliary members* to sub-committees in an advisory capacity. The Committee of Revision and Board of Trustees approved a recommendation that sub-committee chairmen be permitted to nominate auxiliary members for their sub-committees, the nominations to be subject to the approval of the General Committee and Board. It was pointed out that in this way the active help of many specialists through experimentation and comment would be secured for the revision and also new pharmacopœial workers developed, but it has always been definitely understood and accepted by all proposed auxiliary members that the voting power remains exclusively under the control of the regular committee members.

More than seventy auxiliary members have been nominated and approved and many are rendering valuable assistance on sub-committees.

The chairmen of the fifteen sub-committees constitute the *Executive Committee.* This committee is made directly responsible in the by-laws for the revision, but their greatest activity is as individual chairmen of the special groups constituting their sub-committee.

The Executive Committee, however, is called upon to decide questions of a scientific character and aid by discussion and suggestion in the preparation of texts.

To facilitate the filing of communications in the various groups the "Circulars" of the General Committee are mimeographed on white paper, the letters for the Executive Committee on yellow paper, and all sub-committee "Bulletins" on blue paper. All paper is punched for insertion in binders, and individual binders supplied for each set. Whenever a voting sheet

is issued, or a communication to be returned, it is issued in duplicate and on salmon-colored paper and accompanied by a stamped, addressed return envelope.

This has proven gratifyingly effective in securing votes and other responses from the committee, and usually more than 80 per cent. of the members respond within the time limit.

Co-operation.—The current revision has been receiving co-operation of the most valuable character from every affiliated interest. Medical associations and individual physicians have responded to requests to help in the settlement of the therapeutic questions, the several departments of the Government, whenever called upon, have responded promptly and the Bureau of Chemistry have organized a committee of experts within the Bureau to study and help every department of the revision. Many valuable suggestions come from the papers presented at the meetings of the A. Ph. A., American Drug Manufacturing Association, Association of Official Agricultural Chemists and various State and other drug associations. Individual pharmaceutical manufacturers and colleges of pharmacy have also been aiding the revision and a special service rendered by colleges of pharmacy has been the abstracting of texts from foreign pharmacopœias for the use of sub-committee chairmen.

Scope.—Early in the revision it was agreed that the decision concerning admissions and deletions for the Tenth Revision would be placed in the hands of the Sub-committee on Scope. This is a representative committee of physicians and pharmacists, and it has earnestly endeavored to advance the true value of the Pharmacopœia by restricting admissions to remedial agents which possess undisputed therapeutic value or are pharmaceutic necessities. The labors of this sub-committee are not yet completed and their decisions are subject to reconsideration by a special committee, but work has advanced far enough for a public announcement to be of interest. A number of titles, about two hundred, including chiefly galenical preparations which were left until last, have not yet been reported upon to the General Committee, but are all under discussion in the sub-committee. Four hundred and seventy-five (475) articles, formerly official, have definitely been admitted to the U. S. P. X.

The following new articles, twenty-seven in number, have been recommended for the U. S. P. X., it being understood that several in the list may not be finally admitted because of legal or other complications:

Acetyl-Salicylic Acid	Dichloramine-T
Acetyl-Tannin (Tannigen)	Phenobarbital
Carbromal	Oleum Chaulmoograe
Adrenalin	Procaine Hydrochloride
Solution of Adrenalin Chloride	Protargol
Albumen Tannate	Sodium Diphosphate (NaH_2PO_4)
Argyrol	Dextrose (Chemically pure)
Arsphenamine	Anesthesin
Neo-arsphenamine	Dakin's Solution
Barbital	Chloramine-T
Barbital-Sodium	Sajodin or similar type
Barium Sulphate	Pyramidon
Benzyl Benzoate	Chlorinated Paraffin (for Dichloramine-T)
A 20% preparation of Benzyl Benzoate	

Referring to trade-marked or patented chemicals proposed for admission, it is gratifying to announce that the Winthrop Chemical Company, Incorporated, which controls several of these, have assured the chairman that they should be pleased at their inclusion in the Pharmacopœia, under appropriate conditions.

The conditions suggested are the use of descriptive chemical names, omitting the trade-marked titles.

For instance, "Luminal," if admitted, might be called "Phenobarbital" with the synonym "Phenylethylmanolylurea." The title of "Adalin" might be "Carbromal" and the synonym "Bromdiethyl-acetylcarbamide," and for "Veronal," the title "Barbital," with the synonym "Diethylbarbituric Acid." The descriptive titles "*Phenobarbital*," "*Carbromal*" and "*Barbital*" were all dedicated to the public use during the war and might properly find their place in the Pharmacopœia.

Where this policy is followed, the owners of trade-marks would use them as an indication of their special brand, and thus retain valuable rights, while other manufacturers who secure

licenses to make the product would likely adopt a special name, but would also use the Pharmacopœial title. This policy, where accepted by chemical firms, is much broader and more liberal than that usually taken and will no doubt be heartily approved by the medical and pharmaceutical professions.

The chemical foundation now controlling the licenses for a number of the manufacturing processes seized during the war, under the Enemy Trade Division of the Federal Trade Commission, has also expressed the opinion that there was no objection to the use in the Pharmacopœia of such titles as Arsphenamine and Neo-arsphenamine; also Barbital, Procaine and Cinchophen.

It will probably be desirable to include in the U. S. P. introductory notices a statement to the effect that since existing patents are involved in the manufacture of certain official products (listing these) a license from the owner of the patent is required for their manufacture.

The Sub-committee on Scope recommends that the following articles official in the U. S. P. IX. be not admitted to the U. S. P. X.:

Acidum Gallicum
Acidum Hydrobromicum Dilutum
Acidum Hydrocyanicum Dilutum
Acidum Hypophosphorosum Dilutum
Acidum Nitrohydrochloricum
Acidum Nitrohydrochloricum Dilutum
Aethylis Carbamas
Alumini Hydroxidum
Ammonii Iodidum
Ammonii Salicylas
Ammonii Valeras
Amygdala Dulcis
Anisum
Aqua Rosae
Aqua Aurantii Florum
Argenti Oxidum
Arnica
Aspidosperma
Auri et Sodii Chloridum.
Bismuthi Betanaphtholas
Bismuthi et Ammonii Citras
Bismuthi Subsalicylas
Bromoformum
Caffeina Citrata
Caffeina Citrata Effervescens
Calcii Glycerophosphas
Calcii Hypophosphis
Calcii Sulphidum Crudum
Camphora Monobromata
Cerii Oxalas
Chondrus
Cimificuga
Cinchoninæ Sulphas
Copaiba

Coriandrum
Diacetylmorphina
Diacetylmorphinæ Hydrochloridum
Diastasum
Ferri et Quininæ Citras
Fluidextractum Sarsaparillæ Compositum
Foeniculum
Frangula
Guaiacum
Guarana
Humulus
Hydrargyri Oxidum Rubrum
Hydrastina
Hydrastininæ Hydrochloridum
Lactucarium
Liquor Sodii Arsenatis
Lithii Bromidum
Lithii Carbonas
Lithii Citras
Maltum
Mangani Dioxidum Praecipitatum
Matricaria
Mezereum
Morphina
Moschus
Oleoresina Petroselini
Oleoresina Pinaris
Oleoresina Zingiberis
Oleum Cubebæ
Oleum Pimentæ
Oleum Thymi
Petroselinum
Physostigma
Pilocarpus
Piper
Potasii Hypophosphis
Pyrethrum
Quininæ Salicylas
Sabal
Sanguinaria
Sarsaparilla
Sassafras
Sinapis Alba
Sodii Arsenas
Sodii Arsenas Exsiccatus
Sodii Glycerophosphas
Sodii Hypophosphis
Sodii Perboras
Sodii Phenolsulphonas
Sparteinæ Sulphas
Spigelia
Staphisagria
Strontii Bromidum
Strontii Iodidum
Strychnina
Sumbul
Syrupus Calcii Lactophosphatis
Syrupus Hypophosphitum
Syrupus Sarsaparillæ Compositus
Taraxacum
Triticum
Uranii Nitras
Veratrina
Viburnum Prunifolium
Xanthoxylum
Zinci Carbonas Præcipitatus
Zinci Phenolsulphonas
Zinci Valeras

Metric Abbreviations.—The Committee of Revision adopted at its first meeting the abbreviation "cc" to replace "mil" for

liquid metric measure. The bureau of standards would prefer the abbreviation "ml" but object, with many others, to "mil" and prefer the adopted abbreviation "cc" if the committee will not accept "ml."

The spelling "gram" has also been adopted to replace the former "gramme," but the old abbreviation "Gm." had been retained. There has been some criticism in the committee of the evident discrepancy in these abbreviations, the "cc" being neither capitalized nor written with a period, the "Gm." being both capitalized and followed by a period. The Bureau of Standards have adopted the letter "g" without period or capitalization as the abbreviation for "gram," but this is obviously unfit for Pharmacopœial use, since it would be constantly misunderstood to mean "grain," an amount representing less than one-fifteenth as much. The abbreviation "gm." is equally objectionable, because of its possible confusion with the abbreviation "grn." for "grain," so that the abbreviation "Gm." seems alone acceptable for medical and pharmaceutical use.

Preparation of Manuscript.—As the revision has progressed, a plan has developed which promises excellent results. When the sub-committee has completed its study of an article and submitted it through the General Chairman to the consideration of the Executive Committee and the new comments received have been given the necessary study, the text is then carefully edited. This new text, proposed as the form for the U. S. P. is then placed before the General Committee in duplicate, one set to be returned within two weeks. The members of the committee are requested to read this copy with the same degree of care heretofore given "galley proof," considering first the scientific facts presented, but also form, English construction, punctuation, typographical errors or any other feature presented. It is believed that this plan will eliminate most of the corrections when texts are placed before the committee in type and thus reduce the time and expense involved.

About fifty organic chemical texts have been placed before the committee in this form and fifty more are ready. The response has been most gratifying, about forty of the members having returned proofs, many offering valuable suggestions.

The next step will be a published abstract of the changes

proposed in text which have reached this stage of revision and only when texts have passed through this complete course can the final manuscript be made up.

Date of appearance for the next U. S. P.—For several decades there has been strong pressure brought upon the Chairman of the Committee of Revision to fix a definite date for the appearance of the new book. After the very successful conference of the committee in Philadelphia last July, one of the pharmaceutical journals predicted the appearance of the U. S. P. X. in late 1923.

Those who have had experience in Pharmacopœial revision know that the fixing of a definite date for its appearance is a mistake. First, because, if ample time is given after the book appears before the new standards are enforced, no interest suffers by withholding even a prediction of the time for its publication, and, secondly, because no one can forsee the complications and delays which may arise where so large a committee is working on a voluntary basis, and a failure to meet a promise would only bring criticism, embarrassment and disappointment to all.

The chairman and committee ask that those interested in the new revision accept the assurance that an earnest effort is being made to complete the new book as rapidly as is consistent with a thorough and creditable revision and that the proposed changes when published will of themselves be a fair indication of the progress of revision. Furthermore, it must be remembered that the printing of a book like the Pharmacopœia, with proof-reading by a large committee alone, requires at least a year for its completion.

SOIL-REACTION IN RELATION TO PLANT-GROWTH.*

At a meeting of the Philadelphia Botanical Club, held recently at the Academy of Natural Sciences, Dr. Edgar T. Wherry of the U. S. Bureau of Chemistry, gave an exposition of his researches on the relation of the soil-reaction to the growth of many of our com-

*Abstract of an address by Dr. Edgar T. Wherry at a meeting of the Philadelphia Botanical Club. Reported by Henry Leffmann, A. M., M. D., Lecturer on Research, Philadelphia College of Pharmacy and Science.

mon wild plants, comprising principally the herbaceous flowering forms. The subject is a comparatively new one in soil-chemistry, and suggests the possibility that the more extensive pursuit of it may consign to the scrap-heap a great deal of the data gathered during the last fifty years.

Soil-analysis has been pursued actively, and large amounts of money have been expended in its promotion in many nations. The U. S. Department of Agriculture has published many volumes of text and maps, giving results of such work in different parts of the country. Except, possibly, pastoral life, agriculture is the oldest systematic human employment, and for many centuries was conducted upon purely empirical methods, mixed with not a little superstition. Isolated and imperfect experiments were made from time to time in the centuries that immediately followed the revival of learning, but the practical ignorance of the composition of air, and the lack of correct methods of analysis of soil prevented any valid conclusions. Van Helmont weighed and planted a small tree in a tub after having weighed the earth therein, and watered the ground regularly. After the tree had grown considerably, he weighed it and the earth, and finding that the latter was about the same weight as at first, while the tree had gained a great deal, inferred that the water had been converted into plant tissue. He, of course, overlooked the carbon taken up from the carbon dioxide of the atmosphere.

A little before the middle of the last century, Justus Liebig presented, by request, to the British Association for the Advancement of Science an extensive report on organic chemistry in its relation to agriculture and physiology, which appeared somewhat later in English as "Agricultural Chemistry." In this he discussed the chemistry of the assimilation of the forms of plant food, and developed very extensvely the general principles upon which the study of plant nutrition has been pursued. He disapproved of the view that the emission of carbon dioxide by plants in darkness is a process of respiration, attended by a corresponding absorption of oxygen, and his attitude in this respect prevented the acceptance of such a view for many years.

For many years it was held that the fundamental condition for nutrition of plants is a supply of carbon, nitrogen, potassium and phosphorus in such combinations as can be easily absorbed and dif-

fused through the plant tissue. The carbon can be derived from the carbon dioxide of the air, the nitrogen can be obtained most satisfactorily from ammonium compounds and nitrates, the potassium and phosphorus from the natural salts of those elements. Continued experimenting, however, showed that many accessory conditions were influential, and the list of ingredients necessary to a fertile soil was being continually expanded. Bacteriology came into the question. The soil under all ordinary conditions is very rich in these organisms, and they play a much more important rôle than was at first supposed. They transform both organic and mineral matter into forms more assimilable by the plants.

Still more recently a new view of soil chemistry has come to the front, to the study of which several observers are giving much attention. This is based on the ionization of the soil solutes, that is, the substances dissolved in the water with which the soil is impregnated. It has been clearly established that the degree of acidity as determined by titration with alkali and an indicator, or a similar titration of an alkaline solution by an acid, gives but limited information as to the actual condition of the liquid, especially as to its reactions with living organisms. If we titrate equal volumes of two solutions, one containing acetic acid in the ratio of 60 parts by weight in a certain volume, and the other 63 parts of nitric acid in the same volume, the two liquids will require the same amount of alkali, but the actual conditions of activity of two acids is very different. In dilute solution, the whole of the nitric acid will be ionized, that is, all its hydrogen atoms will have assumed a positive charge, and all the NO_3 groups a negative charge, which will give them much higher activity. On the other hand, only a small proportion of the acetic acid has been so affected, and only a small number of its $C_2H_3O_2$ groups are in full activity. Alkali neutralizes the active groups, but as fast as such groups are removed, other acetic acid molecules ionize, and thus the supply is kept up until complete neutrality is affected. When acting against a living cell, however, no such neutralization takes place, so that the specific action is governed by the extent of ionization of the acid present, or if the reaction is alkaline by the degree of hydroxyl ionization.

The general subject of hydrogen-ion concentration has been extensively investigated of late years, and a system of symbols devised, which, after some irregularity, has been in large part, as far

as American writers are concerned, unified as pH. To this symbol an exponent is attached representing the degree of ionization in definite terms. Dr. Wherry has suggested special words for approximating different degrees, and among these is that the states of very small acidity and alkalinity shall be designated as "circumneutral."

The investigations have been carried on for some time, among a great number of plants and in very different regions. In his address, Dr. Wherry showed many illustrations of plants in place, and gave the facts in regard to the reaction of their soils. The determinations were made in the field. Small portions of the soil of the given plant close to the root were mixed with pure water and, after a short time had been allowed for the soil solution to mingle with the water, a clear portion of it was tested in depressions in a porcelain plate with the series of colors now available for the purpose. This is a special series of complex synthetic indicators, each of which has a distinct color-change for a given degree of ionization. This method is very convenient, and likely to be more accurate than the transportation of portions of soil to the laboratory.

The investigations so far made along this line by observers in different parts of the world show a fair degree of unanimity, indicating that each species of plant has its reaction preference, growing to best advantage under a certain condition of either acidity or alkalinity. Incidental points of much value in practical agriculture are foreshadowed by some of the data obtained. Thus, it has been found that the potato can flourish in a soil which has a reaction that is inimical to one of its parasites, so that by maintaining a proper condition the plant may be protected from disease. Some plants show, however, a degree of indifference to the soil reaction, growing about equally well in mild conditions of both alkalinity and acidity. Whether this difference is really due to a difference in specific form, not evident in the general appearance of the plant, is yet to be ascertained. In considering this subject, we must not overlook the fact that ordinary soil is not merely a store of inorganic food which the roots of the plant absorb, but a collection of organisms which are sensitive to the reactions of the soil-solution. Extended experience has shown that highly acid or alkaline soils or those heavily charged with neutral salts will interfere with many plants. The distinction between the marine and fresh-water flora emphasizes these facts

very strongly. Farmers have long known the injury that may be done by the too liberal use of acid phosphate as a fertilizer, producing a "sour" soil. In general, bacterial organisms thrive best in a medium alkaline to the common indicators, and most catalysts are also so affected. The general fertility of limestone soils has been known to agriculturists for many years.

The question may be asked as to origin of the acids of the soil. So far as unfertilized soils are concerned, the acidity in most cases is due to the decomposition of leaf structures. These fall on the ground dead, become the prey of many forms of simple organisms, and their complex proximate principles are converted into acids which are often collectively described as the humus acids. Carbonic acid is also a product of this action and is probably present in notable amount in all soils.

The subject is one of great complexity, the investigations of which are yet in their infancy. Many studies will have to be made over a great variety of plants and soils before positive conclusions can be drawn. Apart from the mere fact that a given plant is associated with a given soil-reaction, it may be found that by modifying such reaction within moderate limits, the character of the growth can be modified. It may be possible, therefore, to feed plants for certain products just as it is possible to feed animals for specific results. Those engaged in raising drug-yielding plants may discover soil conditions that will increase the production of the particular ingredient for which the plant is grown. The questions are purely practical in their present aspect, but the physiologist and chemist will have before long the duty of searching out the exact biologic reactions which determine the preferences in each case. Physical chemistry will be of direct importance; the earlier work of Graham, Dutrochet and Pfeffer will find wider and wider applications in both theoretical and practical agriculture, but it will probably be a long time before the questions as to whether the atom is a mere vortex of forces, and whether time is the fourth dimension, will need consideration by the bio-chemist.

RADIUM: WHAT IS IT? WHAT DOES IT?*

By Arthur W. Goodspeed,

Professor of Physics, University of Pennsylvania.

The duty has been imposed on me to state briefly, something of the physical properties of radium; what is it and what does it. It is the element which was discovered by Pierre and Mme. Curie more than twenty years ago. It occurs in all the ores which contain the well known element uranium. The subject is so broad and contains so much of well known and unknown science, that I will occupy a few moments in showing two or three demonstrations of radium and the material which comes from radium just as it itself comes from the parent substance which produces it. Radium seems to be the key to inorganic evolution. Just as everything organic changes with comparative rapidity, so it has been shown by a study of radium and some other inorganic substances that they too are constantly undergoing a change and that the radium which we have all read about and which we are always learning more about, was originally a part of the inorganic element uranium. In the changes of uranium down through various substances we have three or four steps before arriving at radium. Uranium is the most massive of any element we have and perhaps for this reason it is more likely to change spontaneously. Radium is known to disintegrate into a definite number of substances and this is accompanied by the ejection of several kinds of so-called rays, known as alpha, beta and gamma rays. The alpha rays are material particles atomic in size carrying a positive electric charge. After losing this charge these particles are helium atoms. The beta rays are particles subatomic in size and are atoms of negative electricity, *i. e.*, electrons. The gamma rays are like light rays of exceedingly short wave length. They are similar to very short X-rays. The radioactive process is an atomic explosion, the particles being emitted with great speed from $^1/_{10}$ to $^9/_{10}$ that of light. This implies a vast store-house of intra-atomic energy. A gamma ray starts as an ether pulse at the instant an electron is emitted, just as an X-ray starts when an electron is sud-

*An abstract of a Foyer Lecture delivered at the Academy of Music, Philadelphia, December 13, 1921.

denly stopped. Starting and stopping is just the same kind of an act, one being the negative of the other.

I have here a small piece of uranium ore known as carnotite which is the chief source of radium in this country. As it contains, however, only about 2 per cent. of uranium the radium content is only about five milligrams per ton of the ore. It is readily seen why radium is so expensive to obtain; there is very little of it and the labor necessary to get it is very great. The material that Mme. Curie worked with in her early experiments in 1898 was the residue of some of the Austrian uranium mines after the uranium had been extracted from the ore. Becquerel had discovered in 1896 the remarkable property of uranium known as radioactivity and this suggested to the Curies the probable existence of other substances in uranium ore. Thus Mme. Curie with her husband came to find radium a far more active substance than uranium. At once other chemists in Europe separated small quantities of radium and I have the privilege of showing you the first samples of radium to be seen in this country. This was in 1899. My predecessor at the University, Professor G. F. Barker, was in Europe at the time and secured these from the de Haën Laboratory in Hanover. The percentage of radium content in these samples is obviously very small but note that the material cost but $2 per gram while the single gram recently acquired by Mme. Curie cost our ladies of America about $100,000. Please notice the blue color of the bottles which has been produced by the rays. Also a very faint luminosity can be detected in the dark. This is interesting as many substances acquire this property while radium rays impinge upon them. One of my associates at the University, Dr. Kabakjian, after at least two years of effort has worked out a very efficient method for extracting radium from low grade carnotite and his process is being used at the Radium Chemical Works at Lansdowne near this city and I am indebted to Mr. W. L. Cummings, the proprietor of that plant, for the loan of several thousand dollars worth of radium for experiment here. This morning Dr. Kabakjian very kindly prepared for me this cylindrical glass tube thinly coated within with zinc sulphide.

The first disintegration product from radium is a gas which is itself many fold more active than radium. An atom of this gas is formed by the expulsion of an alpha particle from an atom of radium and the gas is called radium emanation or niton. It is thought

that these atomic reductions go on till finally a lead atom results. If there is further change it is so slow as to escape detection.

Within the tube referred to and which I hold in my hand a very minute quantity of the gas niton has been placed. Within the Dewar flask there is liquefied air which is exceedingly cold having a temperature of 190° C. If I dip the tube part way in the liquid air the niton within will be precipitated as a solid upon the zinc sulphide because of the cold and the salt will at once become quite luminous over the surface immersed due to the impacts of the ejected alpha and beta particles and the gamma rays. This process will quickly proceed till most of the niton is condensed and the lower part of the tube is very bright. These particles are emitted with the tremendous speed of 20,000 miles per second and more. We may thus picture to ourselves a possible mechanism through which radium produces a therapeutic effect either for good or ill. These particles are very, very fast moving bullets which may destroy organisms when they hit.

But I must hasten to another experiment which Dr. Kabakjian has prepared for us, and which illustrates a result from his own researches in radioactivity. He has named the phenomenon thermo-radio-luminescence. Here is a tube which contains 25 millgrams of radium bromide of rather high grade. It was heated some hours ago and under the bombardment of its own rays it is perhaps the brightest specimen of radium any of you have ever seen. The energy transformations in this experiment seem to be in a reverse order from those in the well known phenomenon of thermo-luminescence in which the specimen is first subjected to the action of rays and then heated.

Since radioactive substances are constantly ejecting particles and radiation, the inference is that the energy used is within the atom and thus we have discovered a vast store-house of intra-atomic energy which in the case of each atom can be calculated though it cannot now be controlled. For example if it were possible to extract and use at will the total intra-atomic energy of the gram of radium Mme. Curie has recently received it would be sufficient to transport her with her two daughters in an automobile from here to her birthplace in Warsaw if we only had a good bridge over the Atlantic.

ABSTRACTED AND REPRINTED ARTICLES

THE LEECH AS A REMEDIAL AGENT.

Usefulness of These Little Fresh Water Annelids Still Persists Despite Advances in Therapeutic Science Since the Ancients First Described and Made Use of Them.

(Reprinted from *The Pharmaceutical Era.*)

Although the leech is not given a place in the United States Pharmacopœia, it is nevertheless an important remedial agent. Indeed, it is doubtful if any agent or drug of animal origin has ever been more prominently brought under notice than the leech, both on account of its use in medicine from a very early period, and on account of its fitness for anatomical and other investigations relating to the study of the animal organism. The leech has formed the subject of treatises, inaugural, historical and structural, the number devoted to it being very considerable.

KNOWN TO ANCIENTS.

From the historical side the ancients seem to have been well acquainted with leeches, but it is doubtful if they knew much about their use as a remedial agent. In Greek medicine, apparently, leeches were not known until a comparatively late date, the first mention of them being ascribed by some writers to Themison of Laodicea, who is said to have practiced in Rome about 50 B. C. Besides being the first known physician to make use of leeches for remedial purposes, Themison is also credited by Wootton ("Chronicles of Pharmacy") with being the first to use the famous Pulvis Aloe at Canellæ or Hiera Picra, "a remedy which can be bought in any drug store in Europe or America today, just as it could in Damascus, a thousand, or in Rome and Alexandria, two thousand years ago."

During the middle ages practically all of the Latin and Arabian medical writers described the uses of leeches, as well as the methods of keeping and applying them, and, furthermore, of meeting casualties which might occur from their employment. In early Roman literature Horace seems to have been well acquainted with the tenacity or

"sticking propensity" of the leech, for he manifestly makes use of this proclivity as an example of perseverance. Thus, in his observation, "*non missura cutem nisi plena cruoris hirudo,*" which literally translated means that "a leech does not quit the skin until it is full of blood."

While the zoologist is able to enumerate many species of leeches, only two varieties are usually employed for remedial purposes. These are officially described in the British Pharmacopœia as fresh water annelids, the varieties being the speckled leech (*Sanguisuga medicinalis*) and the green leech (*Sanguisuga officinalis*), the term "sanguisuga" meaning "bloodsucker." They have a soft, smooth body, about 5 centimeters in length, tapering to the extremities, both of which are provided with disc-like suckers. The anterior sucker is the smaller and surrounds the tri-radiate jaws, by which the leech effects an incision in the skin. The body is marked with from ninety to one hundred annulations, the dorsal surface being olive-green, with six rusty-red longitudinal lines. The ventral surface of the speckled leech is greenish-yellow, with black spots, while the ventral surface of the green leech is olive-green, with a black line.

THEY VARY IN SIZE.

This official description fits most of the leeches imported into this country. As described by one importer, the leeches are usually olive-green to brown, with darker patches and spots scattered over a paler ground, a full gray-brown to dark-green or black being the predominating colors. They also vary much in size, some being less than half an inch in length, while others measure from three to five inches. There are leeches belonging to the same family which are said to measure fully two and a half feet in length, but these are rarely used, as they would extract too much blood. Most of the leeches imported here come from France, Italy, Russia and Germany. Before the beginning of the World War, Hamburg was one of the principal exporting centers for leeches from Poland and the Ukraine. Exports of leeches from Turkey, Wallachia, Egypt and Algeria, are also occasionally noted, while Bordeaux is an important center for supplies reaching practitioners in the French Republic.

Many travellers have written interesting descriptions of the methods employed by the natives of different countries in gathering leeches. In some places ponds are maintained for the propagation of

leeches, and they say it is not an uncommon practice in some sections for the dealers to drive horses and cows into the ponds in the belief that the leeches by sucking the blood of the animals will fatten and propagate more abundantly. Not infrequently children are employed to catch the leeches by hand, while grown persons wade into the shallow waters in the spring of the year and catch the leeches which adhere to their naked legs. In summer when the leeches have retired to deeper water, a sort of raft is constructed of twigs and rushes by which a few are entangled. Baits of liver are also employed to gather the leeches, these attaching themselves to the bait being then removed by hand. By some writers this method of capture is said to make the leeches sickly.

A HARDY ANIMAL.

Menniere, writing nearly fifty years ago, interestingly described the leeches common to the marshes of Anjou. Practically all species were represented as well as numerous varieties. In certain varieties a considerable difference was found to exist, depending upon the character of the marsh where the leeches were reared. These differences, he reported, were easily distinguishable by the experienced fisher, who was able to tell the official leech, which had lived in the marsh in the midst of vegetation from one which had been taken in waters free from vegetable growth. In fact, the same varieties of leeches which had been taken from different sources no longer presented identical characteristics. Menniere attributes only secondary importance to the expressed belief of some persons that the color of the water influences the color of the leech, but he does contend that the chemical nature of the water has an important bearing upon the abundance or scarcity of the leeches which are to be found in a given region or district.

Usually leeches are quite hardy, although they are sometimes subject to great mortality. The Edinburgh Dispensatory, published early in the nineteenth century, more than a hundred years ago, records an epidemic that destroyed very generally the supplies of leeches of many druggists in the United Kingdom during the years 1798 and 1799. The cause of this epidemic seems not to have been known. Probably one of the causes of greatest mortality among leeches is due to the manner in which they are stored or kept. Some dealers state that it is necessary to keep aquatic plants in the vessels

or jars in which the leeches are stored, the presence of such vegetation, it is claimed, providing a structure against which the leeches may rub to rid themselves of the slime which their skin exudes.

HAVE BAROMETRIC QUALITIES.

Leeches change their skin frequently, and at such periods they are subject to indisposition and show no eagerness to bite. It is claimed by some writers that leeches are most averse to biting in cloudy or rainy weather, or in the evening. One French observer some years ago reported the effect of the weather on leeches by saying that the leech is an excellent barometer. If the leech remained curled up at the bottom of the container or aquarium, the action indicated fine weather. When it rises to the surface, unsettled or rainy weather should be expected. If it moved about rapidly, a windy spell was imminent, while if the leech indulged in convulsive somersaults, thunder was at hand.

In practical medicine, leeches are used to reduce congestion and inflammation in such conditions as pleurisy, pneumonia, ophthalmia, pericarditis, inflammation of the ear and kindred affections. Each leech is said to draw on an average about ninety minims of blood, which when so withdrawn, loses its property of coagulating. This loss of coagubility is due to the admixture of the blood with the pharyngeal or buccal secretion of the leech which contains the active substance known as "hirudin." In the act of sucking, this secretion is also injected into the place bitten, and is in some degree the cause of the persistent hemorrhage that sometimes follows the removal of the leech.

Leeches should not be applied directly over the inflamed tissue, but to the surrounding area. Neither should they be allowed to take hold directly over a superficial artery, vein or nerve, or be applied to a part where the skin is delicate or where there is a large amount of loose cellular tissue, as the eyelids, since extensive discoloration may result from the super-induced hemorrhage.

Leeches are usually applied to the part affected by means of a leech glass; or a hole may be cut in a piece of blotting paper, and the leech confined to its position by a pill box or tumbler. It can also be easily applied by inserting it tail first in a small, narrow bottle, and then inverting the bottle and holding it against the skin at the

point desired. If the leech refuses to bite, the skin, after thoroughly cleansing, should be moistened with a few drops of sweetened milk or a little blood drawn from some other part of the body.

HOW TO STORE THEM.

While a single leech will draw from one to two teaspoonfuls of blood, after-bleeding may greatly increase this amount. If the leech does not fall off when desired, a little salt sprinkled over it will cause it to loosen its hold. A leech should never be used twice, neither should it be pulled off with the fingers. When it is removed after having abstracted sufficient blood, it should be thrown into the fire and burned. Never throw it into the toilet bowl. The practice of using over again leeches which have been made to disgorge the blood they have sucked, is to be condemned, as there is danger of carrying infection from one patient to another. Excessive bleeding from leech-bites after removal of the leech may be stopped by continued pressure with the application of lint, by the use of collodion, or by touching the wound with lunar caustic. The dusting on of a little powdered alum has also been recommended.

Various methods and containers have been suggested for storing leeches and keeping them alive. J. A. Firestone & Brother, of Scranton, Pa., one of the largest receivers of imported leeches in the United States, and to whom we are indebted for some of the facts herein set forth, say that leeches are best kept in a jar of water covered with a perforated top and having a little mud in the bottom. It is not necessary to change the water daily. Some druggists find it advantageous to place moss or aquatic plants at the bottom of the container, contact with these growths enabling the leeches to free themselves from slime. Other dealers keep as many as 50,000 in a large tank of water, the tank being floored with soft clay and pebbles.

For the local abstraction of blood, leeches are to be preferred to cupping glasses, especially where the parts are very sensitive. Of course, where the parts are irregular, only leeches can be used. Unquestionably leeches "constitute an important therapeutic agent and in many instances give to the physician a control over disease which he could obtain in no other way." The most common objection one hears to the use of leeches is that it is often almost impossible to get them when they are most needed.

THE RELATION OF PHARMACOLOGY TO LEGAL MEDICINE.*

By Robert A. Hatcher,

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Pharmacology, in the broadest meaning of the word, is synonymous with medicine; in the narrower sense in which it is commonly used it means the science that deals with the actions of drugs on animal tissues, including those of man. The therapeutic use of drugs is based on a knowledge of their pharmacologic actions. Thus, pharmacology teaches that morphine and codeine both relieve cough, but morphine has many other actions, and the therapeutist must decide in any given case whether it is better to use morphine or codeine.

Chemistry and therapeutics have so long held the ascendency in legal medicine that the rapid development of modern pharmacology has not received much consideration from members of the bar. It is not the purpose of this article to convey the impression that chemistry and therapeutics have become less important in legal medicine. On the contrary, their importance has increased with advances in our knowledge of those sciences, but it is necessary to direct attention to ways in which pharmacology is capable of serving the ends of justice. This may be presented best, perhaps, by means of a few examples taken from experience. Full details cannot be given without betraying confidence, but such details are not necessary in a paper which is intended to be suggestive only.

The writer does not vouch for the accuracy of every statement that was made to him in presenting the cases, but the arguments are based on the assumption that such statements were correct.

An adult was drowned; a chemist isolated more than a grain of morphine from the liver, bile and intestine, but he could not say how much of the morphine was found in each of these. The testimony showed that the poison had been swallowed some hours before death. The writer was asked whether in his opinion the deceased would take morphine for the purpose of rendering suicide by drowning painless.

*Reprinted from *Law Notes*, November, 1921.

He could form no expert opinion on that subject. He could testify that in his opinion the deceased would not be in a condition to carry out the several steps that were necessary to commit suicide in the manner indicated, because enough of the morphine had been absorbed to induce narcosis. He could also testify that narcosis would greatly facilitate the murder of the deceased by drowning in the manner described. It may be added that much valuable information could have been gained had the writer consulted with the chemist before the examination for morphine was made.

The accused became convinced of the weakness of their defence—that the deceased had taken morphine to render suicide by drowning painless—and confessed to the murder.

A woman drank a glass of a beverage, her husband tasted the beverage, the remainder of the contents of a bottle of which he had poured into a glass; he complained that it was too bitter and threw it out. Both had convulsions; the woman died. The beverage had been purchased by the case, which was kept in the cellar, and the bottle had been opened immediately before the incidents described. The nature of the convulsions suggested poisoning by strychnine, and a few drops of the beverage, obtained by draining the glasses and the bottle, were sent to the writer for examination. He was able by means of experiments on frogs to estimate that the bottle contained about four grains of strychnine; the amount present in the specimen submitted was far too small to be isolated in pure form and weighed, hence a chemist could not have determined the amount present by chemical means.

A pharmacologist would deduce from the foregoing facts some valuable evidence. It suggests that the deceased died as a result of murder or suicide; that the one who placed the strychnine in the bottle knew about how much would be necessary, because much less would not have proved fatal when a glass of it was taken, much more would have rendered the beverage intensely bitter and unfit to drink. Since most members of the laity have only the vaguest ideas of the actual amounts of various poisons required to cause death, the fairly accurate adjustment of the dosage in this case points strongly to the fact that the guilty person was a nurse, chemist, or physician, or had made careful inquiry of one so informed. Few persons previously possessing such knowledge would in the natural course of events,

have both the motive and the opportunity to add poison to the beverage kept in the cellar of the deceased.

If the husband merely "tasted" the beverage, he did not take enough strychnine to cause convulsions. Were they feigned? Careful investigation could easily have shown the facts in the case. More of the circumstantial evidence in this case might be added, but the writer was given to understand that his duties in the matter ended when he reported the approximate amount of strychnine present in the beverage. Enough has been said, however, to show that the active co-operation of a pharmacologist would be valuable to a prosecuting officer in such a case.

A man took one of ten powders that had been prescribed for him and vomited every day for many weeks thereafter. It was charged that the pharmacist who compounded the prescription made a mistake resulting in this illness. The writer was asked to examine one of the powders in order to determine whether a mistake had been made; a copy of the original prescription was sent with the powder. The examination showed that the pharmacist had indeed made a mistake, but it was of such a character that no possible harm could result from it, as the substance substituted was practically identical with that prescribed, and furthermore, the powders dispensed could by no possibility induce vomiting of the character described.

It may be stated in passing that many people look upon any mistake made in compounding a prescription as certain to cause injury, and there is a widespread disposition to claim damages when there is evidence of a mistake of this character, but in truth the precautions commonly observed in reputable pharmacies render serious mistakes rare, though minor mistakes are not very uncommon.

A man drank part of the contents of a bottle, was taken seriously ill shortly thereafter and was treated by a physician employed by the establishment that furnished the liquid by mistake for another substance. Contrary to the advice of the physician the man left the establishment within a few hours, but was taken ill and was removed to a hospital where he remained a few days. After recovering, apparently, he went to his home and died about three weeks after drinking the fluid mentioned.

The writer was asked at ten o'clock A. M. whether he could testify in court at two o'clock P. M. that the liquid in question was not a poison. He replied that he could not, because it is a poison.

He stated that he could testify that the liquid was not the cause of death. He suggested that a postponement be obtained, that a transcript of the records of treatment and of the symptoms exhibited by the deceased be obtained, in order that these symptoms might be compared with those induced by poisoning by the liquid in question. As far as the writer was able to learn the suit that had been instituted for damages was dropped. It was very easy to show that the liquid did not cause death in this case.

The laity and many members of the legal profession have only vague ideas regarding poisons, the word having a sinister meaning to the average mind, so that it is often difficult to convince one when the has suffered serious injury following the taking of a poison through mistake, that the poison is not necessarily responsible for his injuries. It must be remembered that poisons are frequently taken by mistake by those who are ill and who would not otherwise have occasion to take any drug. Under such circumstances the poison may induce violent symptoms after which the effects may pass away completely, but that does not mean that the disease from which the patient suffers may not continue to grow worse exactly as it would had the poison not been taken. When a patient dies under such circumstances it is easy to attribute his death to the poison taken through error.

While a patient might be entitled to damages for the pain and discomfort induced by the poison in such a case, this is wholly apart from the far more serious question of whether death is the result of the mistake that resulted in his taking the poison. A somewhat analogous condition was presented to the writer after a physician had stated that a mistake of this character had caused injury. Death did not result in this case. The writer declined to testify, as he was convinced that the relatively slight mistake was not responsible for the symptoms attributed to the poison. Such cases demand the close co-operation of the physician and the pharmacologist.

Experiences such as these just detailed might be multiplied indefinitely if one were treating of the subject exhaustively, but it is believed that the cases cited suffice to show that the pharmacologist may often give valuable aid in the solution of medico-legal problems.

NOTE ON PHARMACEUTICAL NOMENCLATURE: NUCLEIN OR NUCLEIC ACID, SCOPOLAMINE OR HYOSCINE.*

By Joseph John Blackie, Ph. C.

NUCLEIN OR NUCLEIC ACID.

There seems to be some doubt and misconception as to the meaning of the two terms "nuclein" and "nucleinic" or "nucleic acid," and perhaps before going any further a short note on the chemistry and preparation of the two substances will help to enlighten matters and show that they are quite distinct articles of pharmacy.

The nucleoproteins are complex compounds which are made up of varying amounts of protein and nucleic acid. Nuclein is the product obtained when a nucleoprotein is hydrolysed. The nucleoprotein on digestion with hydrochloric acid and pepsin is not completely hydrolysed—that is, it is not completely separated. A residue remains which is insoluble in the pepsin solution and consists of protein combined with nucleic acid. This residue is called nuclein. Nucleins are therefore the insoluble residues which remain after the tissue has been digested with pepsin, and it will be seen later that nucleic acid can be separated from the nuclein. The chemical constitution of nucleic acid has not yet been definitely ascertained, but it is said to consist of a carbohydrate, phosphoric acid, purine and pyrimidine bases. Plant nucleic acid differs from animal nucleic acid in the carbohydrate constituent, and also in one of the pyrimidine bases.

The nucleoproteins are present in the pancreas, thymus, etc., but the product met with in pharmacy is usually prepared from the nucleoprotein of yeast. The yeast is extracted several times with dilute solution of ammonia. The mixed extracts are acidified wth dilute hydrochloric acid until faintly acid. The brown or dirty white precipitate obtained is nucleoprotein. From this nucleoprotein, nuclein is obtained by adding dilute solution of hydrochloric acid and a solution of pepsin, and digestion is carried out by incubation for forty-eight hours. The albumin is split off as peptone and the nuclein is precipitated as a brown sediment. It may be purified by dissolving in ammonia and precipitating by the addition of dilute solution of acetic acid.

*Reprinted from the *Pharm. Journ. and Pharmacist,* Dec., 1921.

Nucleic acid is prepared directly from yeast, but may be obtained from nuclein, and so to emphasize the difference between the two compounds a short note on the preparation from nuclein is given. The nuclein is decomposed by adding solution of caustic soda, and the alkali is neutralized by the addition of dilute hydrochloric acid. Acetic acid is then added to precipitate the protein. The solution is filtered, and to the filtrate is added solution of hydrochloric acid in alcohol. The precipitated nucleic acid is collected upon a hardened filter paper, and may be purified by dissolving in ammonia and precipitating with acid alcohol. It is then dried over sulphuric acid. It is a white amorphous powder, slightly soluble in water, insoluble in alcohol and ether, but readily soluble in dilute solutions of potassium or sodium hydroxide. Thus in the chemical constitution and preparation it is seen that the two substances are quite distinct.

The confusion between the two compounds has probably arisen from the description given in the British Pharmaceutical Codex, where the nomenclature is misleading. This book, under Acid Nucleinic, gives the synonyms Acid Nucleic and Nuclein, and the description in the text does not agree with the synonymous terms stated. It states that "if yeast, spermatozoa, or pus cells be extracted with acids a residue is obtained which has been termed nuclein. This residue is acid and contains a considerable amount of phosphorus. If it be further treated with alkalies, or is subjected to tryptic digestion, the protein is split off, the nucleic acid which remains containing all the phosphorus." This description does not justify giving nuclein as a synonym of nucleic acid because it shows that the latter substance is a decomposition product of the former one, therefore quite a separate compound. It goes on to state that "the term nuclein is commonly used as a synonym of nucleic acid, but that it is more correctly applied to the nucleinates intermediate between nucleic acid and nucleo-protein."

The fact remains that by giving nuclein as a synonym of nucleic acid much confusion is caused, because pharmacists when dispensing have not always time to go into details when a prescription is urgently wanted, and by consulting the B. P. C. and noting that the terms are synonymous they take if for granted that that authorty is correct. Nucleic acid is usually prescribed as it is soluble in solutions of weak alkalis with the formation of the corresponding nucleinates, and it is in the form of a five per cent. aqueous solution that it is chiefly

used in medicine. Pure nuclein is not often met with in pharmacy, but the nucleoprotein of yeast is occasionally dispensed under the name of nuclein. This compound, which is the product obtained in the preliminary preparation of nuclein, is insoluble in water and alkalis, and is usually prescribed in tablet form.

In "Squire's Companion to the Pharmacopœia" and Martindale's "Extra Pharmacopœia" the two compounds are clearly and separately described. In the latter book the term nucleol is given as a synonym of nuclein. This is stated in the U. S. "Dispensatory" to be a free form of nuclein.

SCOPOLAMINE OR HYOSCINE.

The terms "scopolamine" and "hyoscine" are synonymous but the former seems to be coming into use by certain sections. There is no reason for this change, as the alkaloid is official in the B. P. as hyoscine hydrobromide, while scopolamine is given as a secondary term. This alteration in nomenclature is probably due to continental influence, scopolamine being in some Pharmacopœias the official name of the drug. Hyoscine, as will be seen later, is the older name of the alkaloid, and being so should be given the preference. Pharmacists and medical men should not drift away from the official to synonymous in their nomenclature.

No pharmacist or medical practitioner would ever think of using the term theine for caffeine or di-sodium hydrogen phosphate for sodium phosphate. These terms, like scopolamine, are considered either as indicating the source of the drug or merely as technical nomenclature, and are given in the B. P. as being of minor importance to the pharmacist. There is no reason, therefore, why scopolamine should be used in place of hyoscine, which was the name first applied to the alkaloid. Hyoscine was the name originally applied by Höhn and Reichard in 1871 (*Annalen,* 1871, 157, 98) to a basic product of the hydrolysis of hyoscyamine, now universally called tropine, and having the formula $C_8H_{15}ON$. Later in 1880, Ladenburg (*Annalen,* 1880, 206, 299) gave the name hyoscine to a new amorphous alkaloid obtained from the mother liquids of hyoscyamine. This he erroneously took to be an insomeride of atropine with the formula $C_{17}H_{23}O_3N$. Schmidt, in 1892 (*Arch. Pharm.,* 1892, 230, 207; 1894, 232, 409), found Ladenburg's new alkaloid had the formula $C_{17}H_{21}O_4N$, and was identical with an alkaloid Schmidt found in the rhizomes of *Scopolo japonica,* and to which he gave the name scopolamine. This

identity of hyoscine and scopolamine was confirmed by Hesse in 1892 (*Annalen,* 1892, 271 120; 1893, 276, 84). Thus, though Ladenburg was not quite correct in his chemical formula, he undoubtedly was the first to give a name to the alkaloid now called both hyoscine and scopolamine. Historically, therefore, hyoscine has the priority. The term hyoscine was accordingly adopted in British pharmacy, and there may be a danger of its falling out of use on account of the introduction of scopolamine.

Scopolamine, as shown above was the name provisionally applied to a crystalline alkaloid isolated by Schmidt from a species of *Scopola,* but when this alkaloid was found to be chemically identical with hyoscine the term scopolamine was probably intended to be dropped. It is, however, given in our books of reference as the synonym of hyoscine, and, in fact, introduced into some Pharmacopœias, where it is fully described, and where hyoscine is given the minor place as a synonym of the drug.

It might be argued that scopolamine describes the alkaloid equally well, because certain species of Scopola give a good yield of the substance, and that the name indicates the source of the drug. Certain species of *Datura,* however, contain hyoscine, and are the commercial sources of the alkaloid; so on the same argument, a name suggesting *Datura* as the source of the drug might be used. This would complicate matters very much and so, to simplify nomenclature, the term scopolamine should be discarded, and the official and old-established name of hyoscine should be the one and only term used.

The retention of the old name of hyoscine was advocated in an article by Hesse, which appeared in *The Pharmaceutical Journal* in September, 1892, where he states "that it would be inappropriate to alter the name of the substance, more especially since the name hyoscine has been long established in medicine and pharmacy as well as in the trade, while, on the other hand, scopolamine, which is scarcely known, would first have to become familiar." He goes on to state "that he would urge chemists to adhere to the use of the name of hyoscine, which was selected by Ladenburg for the base in question, and has been in general use up to the present time." From other remarks of Hesse it would appear that the term scopolamine was not intended to be used, as the name was given only as a temporary measure, there being at the time some doubt amongst chemists whether the two substances were identical or not.

LAC CULTIVATION.

By S. Mahdi Hassen, Bangalore.

Lac is defined as a crude expression for all of the products of an insect called *Tachardia lacca.* Lac upon removal from the tree is called "stick lac." It contains among other things resin, wax and dye. Only the resin usually enters the market either as flat cakes (button lac) or in the form of orange colored sheets (shellac). Stick lac differs in its constituents according to the tree from which it is derived. Koosam lac produced by propagating the insects on *Schleichera trijuga* is claimed to be the richest source of shellac, containing 70 to 80 per cent. of resin, the shellac produced being elastic and of a golden orange color. The central provinces of Western Bengal produce most of the koosam lac.

Pitholobium Saman is the chief host plant of lac in Burma. This lac contains 12 per cent. of dye and gives the shellac obtained therefrom a reddish tinge. Peepal or *Ficus Bengalensis* yields a very pale colored stick lac but its resin is of poor quality. The shellac obtained therefrom is brittle. The greatest amount of lac is derived from Palas or *Butea frondosa.* It contains 60 to 65 per cent. of resin. Barie or *Zizyphus jujuba* yields lac a little superior to Palas, containing about 5 per cent. more or resin. Trees producing lac not inferior to Palas are *Pterocarpus Marsupium, Shorea robusta, Acacia arabica* and *Terminalia tomentosa.* Most host plants of lac belong to the *Leguminosæ.* All of the host plants of lac contain substances like hydroxy acids, tannins and gums. A tree containing tannins and water soluble gums is likely to produce lac.

The lac parasite lives upon the disease of the tree, upon the vigor of the tissue destroying gum bacilli. The lac insect lives upon sweet bacterial gums produced by tissue destruction.

The reason it is not thought that the insect feeds on tissue building sugars is that during the summer, when carbon assimilation is at its best, the crop of lac is very poor.

Tannin is regarded as essential for the production of slime, abundance of gums and so of lac. Among the predisposing agencies in tannin formation are mentioned salts of soda and potash, dry piercing winds and low ground fires.

The enemies of the lac insect include the larvæ of some moths and chalcid flies. To destroy these a wholesale ground fire is recommended.

Since the host plants of lac are leguminous, the nitrogen fixing bacteria which help these trees are constantly in need of fresh air. During summer when these bacteria are very active the hard surface soil should be broken. Grazing animals, termites and ants are valuable agencies in loosening the soil and letting in air. Ants in return for their food protect the lac insect from its enemies and so are helpful to both host and parasite.

Grazing, while useful during the hot season, is injurious during the rains on account of pressing the surface soil.

A soil bad for the forester and worse for the farmer, where more weeds are found than crops and whereon fire annually annoys the forester, is ideal for lac production.

Early crowding and deferred severe thinning is the best treatment for the host plants of lac.

Iron in the soil predisposes the tree to the attack of the lac insect, In conclusion the author appeals for a system of intense cultivation, making the most of the worst possible soils and climatic conditions and viewing lac as a major forest product.

H. W. Y.

RECENT ADVANCES IN FOOD AND DRUG CHEMISTRY.

ABSTRACTS PREPARED BY DR. HENRY LEFFMANN.

The latest report of the United States Bureau of Chemistry, just released for publication, contains many interesting and important notes, from which a few directly concerning pharmacy are herewith abstracted.

NATIVE SOURCES OF CAFFEINE.

The scarcity of Caffeine during the war led to a search by a department of the bureau for possible native sources. The leaves of the *Ilex vomitoria,* which is found along the coast from Virginia to Texas. contain an appreciable amount of the alkaloid, as does also the pulp of the coffee berry, millions of pounds of which become available every year in Porto Rico.

GENUINE SYNTHETIC APPLE OIL.

Studies in the phytochemical laboratory of the bureau have resulted in the discovery of the ingredients of the mixture which gives the characteristic flavor to apples. On the basis of the results obtained, a synthetic oil, identical in composition and properties with that found in apples has been produced and a "public service patent" has been granted for the procedure. This is an important step in the detection of food adulteration, for unless the composition of the flavoring material of given fruit is fairly accurately known, the distinction between the true flavor and substitutes is not definitely ascertainable. Work is being done along this line with peaches, and also to determine if methyl anthranilate is a natural constituent of any varieties of grape and for developing a trustworthy test for this ester.

NEW SUGARS.

The Carbohydrate Laboratory has isolated two sugars with seven carbon atoms, the first of the type so far detected in natural products.

TOXICOLOGY IN THE ANTIPODES.

ABSTRACTS PREPARED BY DR. HENRY LEFFMANN.

In the proceedings of South African Chemical Institute for September last, several accounts of poisonous plants are given. The region is somewhat interesting as being the other U. S. A. Union of South Africa. The data are given by Joseph Lewis, A. M., D. Sc.

ARROW POISON.

Acocantherine is a constituent of Bushman arrow-poison; other ingredients are: snake venom, euphorbia latex and a fluid from the larva of a beetle. Acocanthera is used as an antidote to snake poisoning, but its powerful stimulant action on the heart is such that it is not impossible, Dr. Lewis thinks, that the two poisons may be used together. Euphorbia latex is probably used as a cement. Only two specimens of the poisonous larva were obtained. The poisonous ingredient is probably a toxalbumin. It acts directly on the blood, killing the leucocytes and dissolving the red corpuscles. Direct injection into the blood is far more rapid in action than subcutaneous injection.

Twelve milligrams killed a rabbit in a few minutes by intravenous injection, while several days was required after subcutaneous use. Birds are much more resistant than mammals. Post mortems invariably show in mammals inflammation of the kidneys and intestines, but not of the stomach. Animals can be rendered immune by repeated small doses of the material.

POISONOUS SENSITIVE PLANT.

Under the common name of "Kruidje roer my niet" (Dutch, for "Touch me not plantlet,") several species of *Melianthus* have attracted attention on account of poisoning. *Melianthus comosus* was the cause of the death of a sickly native who was attended by a native doctor. The alcoholic extract of the bark yielded on evaporation a mixture of water-soluble (toxic) material and a resinous substance. The toxic principle is also soluble in ether and chloroform. The only color reaction obtained the material after purification was a momentary salmon pink, changing to brown, with sulphuric acid.

LOVE PHILTRES.

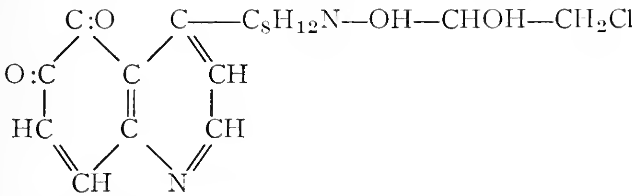
As might be expected, these are much in use among the natives. The misletoe is credited with such powers in South Africa as well as in Europe, but in the latter, the plant is regarded as active when growing on the oak, and in Africa when it grows on the mimosa. Dr. Lewis, however, has not met with any cases of the use of the mistletoe, but noted several instances of the use of cantharides. The beetle lives on several species of *Mylabris*. One instance is reported of the use of a tabloid of blasting gelatine, given to a girl for aphrodisiac effects. The result is not stated.

SCIENTIFIC AND TECHNICAL ABSTRACTS

Oleander.—The amount of digitalis-like active substance in the leaves of Nerium Oleander has been investigated by Walther Straub. He finds the oleander leaves to be 2.5 times as active as digitalis leaves and the aqueous and alcoholic extracts to be very stable. *Archiv für Exp. Path. u. Pharm.* 82, pp.327-43 (1921).

J. F. C.

Thalleioquin.—After an extensive investigation of the subject Christensen has reached the conclusion that thalleioquin is the ammonium compound of 5-6, diketochinchonineoxychloride:



(*Ber. d. d. pharm. Ges.* 26, 2249 [1916].)

J. F. C.

Identification of Acetaldehyde and Formaldehyde.—An intense crimson color is developed by mixing in the cold and in the following order acetaldehyde, phenylhydrazine, diazobenzene (obtained by the action of sodium nitrite and hydrochloric acid on sulphanilic acid), and sodium hydroxide solution. This reaction is stated to be capable of detecting acetaldehyde in dilutions of 1—350,000. Formaldehyde gives an intense blood-red color on mixing cold with phenylhydrazine, metol, and sodium hydroxide. This reaction mixture gives a blue lake with magnesia. It may detect one millionth part of formaldehyde and, used as a test for phenylhydrazine, will detect it in dilutions of 1—250,000; or will detect metol in dilutions of 1—300,000. The test may be directly applied to organic liquids

such as milk, urine, food products, etc. It is prevented by the presence of ammoniacal salts or of any substance able to neutralize the added alkali. J. F. C.

E. Pittarelli, *Arch. di farm. sper.* 30, p. 148 (1921).

Differentiation of the Hydrochlorides of Cocaine, Procaine (Novocaine) and Stovaine.—It is important to distinguish between the hydrochlorides of cocaine and procaine considering that both are products possessing analogous properties. Since procaine is cheaper it is often substituted in whole or part for cocaine. Since procaine is not subject to narcotic regulations it is important that there should be a method for detecting the presence of cocaine in it.

Cocaine hydrochloride (chloride of methyl-benzylecgonine) differs essentially from procaine (chloride of para-aminobenzoyl-aminoethanol) in its chemical composition.

Stovaine is the chloride of alpha-dimethylamino-beta-benzoyl pentanol.

Their appearance, organoleptic properties and solubility in various substances does not serve to differentiate between them. Many reactions are common to all particularly with sodium hydroxide, mercuric chloride, potassium iodide, iodine, silver nitrate and mercurous chloride.

The following reactions and properties will serve to distinguish between them:

	Procaine	*Cocaine Chloride*	*Stovaine*
Physical	Needless, colorless inordorous, feebly bitter	Anhydrous crystals, colorless, bitter and no odor.	White crystalline powder inodorous, bitter, acid reaction.
Solubility:			
Water	1.0 part	0.75 parts	2.0 parts
Alcohol	30.0 parts	Soluble in alcohol at 60° C., difficulty soluble in absolute alcohol.	Soluble, less soluble in absolute alcohol.
Chloroform	Not very soluble	Soluble	Soluble
Ether	Insoluble	Insoluble	Insoluble
Carbon disulphide	Insoluble	Almost insoluble	Nearly insoluble
Benzol	Id	Insoluble	Id
Melting Point	156° C.	183° C.	175° C.
Polarization	Inactive	Lævorotatory	Inactive

	Procaine	*Cocaine Chloride*	*Stovaine*
Reaction	Neutral	Neutral	Acid
Reaction with: $NaNO_3+HCl+$ *b*-Naphthol	Scarlet red precipitate	No reaction	No reaction
Resorcin$+HNO_3$ fuming	Intense red	Id	Id
Phenol	Orange red	Id	Id
Pot. Permanganate	Decolorizes rapidly	Decolorizes very slowly	Decolorizes slowly
$H_2SO_4+H_2O$	No odor, no crystals	Odor methyl benzoate and crystals benzoic acid.	Crystals benzoic acid and odor ethyl benzoate
$HNO_3 + KOH$	No odor	Benzoic ether	Benzoic ether
NH_4OH	Feeble precipitation after several minutes. Liquid opalescent.	Crystallizes immediately. Liquid limpid.	Liquid immediately becomes milky
KOH	Oily precipitate becoming crystalline.	White precipitate	White oily precipitate
$Na_2B_4O_7$	No precipitate	White precipitate	White precipitate less soluble than the cocaine
Na_2HPO_4	Id	Slight opalescence in concentrated solutions	White milky precipitate
$K_4Fe(CN)_6$	Blue ppt.	No ppt.	Slowly ppts.
K_2CrO_4	No ppt.	No ppt. till HCl is added	Oily ppt. dissolves in HCl
$AuCl_2$	Brown precipitate	Light yellow precipitate	Light yellow precipitate.

The use of the nitric acid and resorcin test will distinguish procaine from cocaine and stovaine and the sodium phosphate reaction will differentiate stovaine from the others. The resorcin reaction of procaine is of use in toxicological analysis it being sensitive to .1 milligram of the anesthetic. The *b*-naphthol and resorcin reactions will detect 0.5 per cent. of procaine in cocaine or stovaine.

The sodium phosphate reaction will detect 10 per cent. of stovaine in procaine or cocaine and the borax and sulphuric acid test will indicate the presence of 10 per cent. of cocaine in novocaine.—*(Journal de pharmacie Belgique,* July, 1921, through *Repertoire de Pharmacie,* November, 1921.)

J. W. E. H.

Siam Benzoin.—When Siam Benzoin is dissolved in acetic acid and allowed to stand for several weeks, small colorless crystals of siaresinolic acid are deposited. They correspond to the formula $C_{30}H_{48}O_4$, are monobasic, fuse at 279° C., dextrogyrate in alcoholic solution $[^{(a)}D + 37.79]$, soluble in acetic acid, ethyl acetate, salicylate of soda. The acid contains no methoxyl group but forms salts with both sodium and potassium hydrates.

This benzoin also gives crystalline compounds with other substances. Benzoate of lubinol is soluble in the usual organic solvents except ether and petroleum ether. The salt, which is white, melts at 72° C. and is colored green with iron per-chloride and red with sulphuric acid. It has no rotating power and conforms to the formula $C_7H_{16}O_4$. It has the property of fixing one molecule of bromine. Lubinol is an alcohol similar to the coniferyl alcohols.—(*Arch. d. Pharmacie,* 1921, 1, 60; through *Repertoire de Pharmacie,* November, 1921.)

J. W. E. H.

Solubility of Some Drugs in Glycerin.—The author has determined the solubility at 20° of a number of pharmaceutical chemicals in glycerin of specific gravity 1.2326 and also 1.2645. The determinations were made by keeping the powdered substance diffused through the glycerin at 20°, withdrawing portions of the solution at intervals and assaying. The results were controlled by dissolving excess of the substance in hot glycerin, cooling, standing until the excess had separated out, and assaying; in the latter case a long time was sometimes necessary for complete separation. The following results were obtained, expressed in grammes of substance dissolved by 100 Gms. of glycerin:

	Glycerin s.g. 1.2326.	Glycerin s.g. 1.2645.
Acetanilide	0.93	1.15
Acetyl-salicylic Acid	0.71	0.88
Ammonium Bromide	31.9	27.2
Ammonium Chloride	12.58	10.17
Antipyrine	21.4	17.3
Arsenious Acid	19.5—25.7	35.4—43.5
Benzoic Acid	1.40—1.45	2.20—2.23
Borax	89	111

	Glycerin s.g. 1.2326.	Glycerin s.g. 1.2045.
Boric Acid	13.78	24.80
Caffeine	0.59	0.47
Calcium Glycerophosphate	4.15	3.98
Camphoric Acid	2.36	4.32
Diethylbarbituric Acid	0.78	0.96
Dimethylamidoantipyrine	1.9	1.5
Hexamethylenetetramine	26.5	20.9
Iodine	0.47	0.67
Lead Acetate	129	143
Mercuric Chloride	53.5	75.3
Potassium Acetate	77.4	65.5
Potassium Bromide	20.6	17.2
Potassium Carbonate	40.5	39.4
Potassium Chlorate	1.31	1.03
Potassium Iodide	58.3	50.6
Quinine	0.33	0.96
Quinine Hydrochloride	14.3	16.8
Quinine Sulphate	0.72	1.31
Salicylic Acid	0.97	1.62
Sodium Benzoate	31.5	28.5
Sodium Bicarbonate	4.05	7.86
Sodium Bromide	44.7	38.7
Sodium Carbonate	108—123	78—102
Sodium Chloride	10.37	8.28
Sodium Glycerophosphate	79.7	82.4
Tartaric Acid	115.5—161.7	69.5—114.7

In the case of arsenious acid 20 weeks were found to be insufficient to bring the figures obtained by the cold and by the hot method into agreement; hence both are given. With tartaric acid the figures obtained by the hot method include the acid which had passed into solution in the form of esters.—(*K. Holm* [from *Doctorate Thesis, Amsterdam*]).

Specially Denatured Alcohol for Perfumery.—The following formula, to be known as specially denatured alcohol Formula 39-B, is authorized for use in the manufacture of perfumes, toilet waters, alcoholic barber supplies and lotions:

To every 100 gallons of pure ethyl alcohol add 2½ gallons of diethylphthalate, $C_6H_4(CO_2C_2H_5)_2$.

Diethylphthalate is colorless, practically without odor, and is miscible with alcohol. Boiling point 290° C.-297° C. The ester content should be not less than 99 per cent., determined by the usual saponification method.

Qualitative detection, fluoresceine test: Take five (5) drops of diethylphthalate or 10 mils of the 2½ per cent. solution, place in a small casserole and add 5 mils of a 10 per cent. solution NaOh. Evaporate practically to dryness on a steam bath and then to complete dryness over a low Bunsèn flame. Continue heating until the mass is in gentle fusion. Discontinue heating and add at once approximately 0.5 Gm. of resorcin. The mass effervesces and turns a dark brown. Place a small portion of this mass in a test tube and add water. The characteristic color of fluoresceine develops at once.

This formula should not be used in preparation of an alkaline character as a chemical reaction will take place, which may be detrimental to the finished product.—(Through *Merck's Report.*)

Camphor Substitutes.—Camphor substitutes are now being made in quantity in America from coal tar, according to Mr. C. R. De Long, chief chemist of the United States Tariff Commission. In an address delivered recently Mr. De Long said the high price of camphor during the war led to search for a substitute, with the result that triphenyl and ticresyl phosphates were introduced as substitutes for camphor in the manufacture of pyroxylin plastics. The fact that in the past Japan has enjoyed a complete monopoly of the world's supply of camphor was well known. It was extremely doubtful whether these two coal-tar products could replace camphor in pyroxylin plastics for all purposes, but they offered a means of overcoming to some degree the Japanese monopoly in camphor.—(*The Chemical Age*, through *Merck's Report.*)

NEWS ITEMS AND PERSONAL NOTES

Free Information About Scientific Instruments and Apparatus, Laboratory Construction and Equipment.—The Research Information Service of the National Research Council is prepared to supply to those interested information about scientific instruments, apparatus and supplies, laboratory construction and equipment.

The following are samples of requests answered recently:

"Where may we purchase inexpensive photomicrographic apparatus?"

"Where may a human skull be purchased?"

"Who manufactures a good grade of selenium cells?"

"Advise where lantern slides on European Geography may be obtained?"

"Where may the Lummer-Brodhun cube be obtained?"

"What concern makes gauges recording in fractions of an inch?"

"Where may apparatus and accessories for the study of sensitiveness of photographic plates be secured?"

Address requests: National Research Council,
Information Service, Washington, D. C.

Where to Secure Research Chemicals.—A compilation of research chemicals has been prepared by Dr. Clarence J. West for the Committee on Research Chemicals and the Research Information Service of the National Research Council. The American chemical industry has made a very marked advance during the past few years, and a surprisingly large number of high grade chemicals may now be purchased in America. It has seemed desirable to list these with the names of the manufacturers. The addresses of seventy-four firms are given in this compilation and the list of chemicals occupies eighteen pages, while six additional pages are given to biological stains and indicators.

The so called "heavy chemicals" have been omitted because there are so many recognized manufacturers and dealers from whom they may be secured. For the same reason practically all inorganic salts are omitted. The question of whether or not to include dealers who are not manufacturers was decided in the negative because the number of firms which would have to be included would make the list too long for convenient use. It is recognized that the list has many short-comings, but it is believed that it is well worth while to publish it, in order that with the co-operation of manufacturers and users of these chemicals it may be revised and made as nearly complete as possible.

The Committee on Research Chemicals is a committee of the Division of Chemistry and Chemical Technology of the National Research Council, and is composed of the following experts:

Mr. Wm. A. Collins, Chief Chemist, Quality of Water Division, U. S. Geological Survey, Washington.

Dr. Roger Adams, Professor of Organic Chemistry, University of Illinois, Urbana, Ill.

Capt. D. B. Bradner, Chief, Chemical Division, Chemical Warfare Service, Edgewood Arsenal, Edgewood, Md.

Dr. Hans T. Clarke, Research Chemist, Eastman Kodak Co., Rochester, N. Y.

Dr. W. F. Hillebrand, Chief Chemist, Bureau of Standards, Washington, D. C.

Dr. George D. Spencer, Organic Chemist, Analytical Reagent Investigations Laboratory, Bureau, of Chemistry, Washington.

Dr. Clarence J. West, National Research Council, Washington.

Those interested in this booklet should address the Research Information Service, National Research Council, Washington, D. C.

BOOK REVIEWS

Traitè de Chimie Pharmaceutique Organique. By Maurice Delacre, Professor at the University of Gand. In two parts: Part 1, The Aliphatic Series, pp. 198; part 2, The Aromatic Series, pp. 186; 16 x 23.75 cm. Paris, Librarie Octave, Doin., 1921.

This interesting work follows the orthodox methods of presenting a discussion of the elementary facts and principles of organic chemistry. Stress is naturally laid upon those substances and processes which are of immediate interest to pharmacists while other interesting subjects in organic chemistry are either excluded or are very briefly treated. As an introductory text-book the work will have wide application. The subject matter is wisely chosen and is presented in a simple manner which ought to make it readily intelligible to the student. There is an extensive use of structural formulas arranged so as to be easily understood. Professor Delacre may be complimented upon the lack of complexity in his presentation of some of the more difficult ideas of modern organic chemistry, especially for his discussion of the application of the phase rule to solutions and solubility. The indexing of the two parts is not as extensive as the reviewer would like and the paper used is of poor quality.

J. F. C.

Les Huiles Végètales. By Henri Jumelle, Professor in the Faculty of Marseilles. Paris, Baillière et Fils, 12.5 x 17.5 cm., 496 pages, 1921.

This handy little book comes as a welcome addition to the reference works on the subject of the vegetable oils. The author's purpose is to furnish an essentially practical account of the oils leaving the discussion of the pure chemistry or their constituents to other text-books, of which there are many. Jumelle's book gives the botanical and geographical sources of the oils, the methods employed in their preparation, and the analytical constants

reported. The treatment of many of the subjects is rather brief, but it is not possible in such a general work to devote space to numerous details which are not likely to be of general interest. The book is well indexed, a feature which is not common now-a-days with either French or German publications. The paper and the type leave much to be desired.

J. F. C.

THE AMERICAN
JOURNAL OF PHARMACY

VOL. 94. MARCH, 1922. NO. 3.

EDITORIAL

THE ALCOHOL QUESTIONNAIRE.

At great expense and trouble, *The Journal of the American Medical Association* has lately completed a questionnaire to obtain the opinions of the principal portion of the medical profession in the United States on the therapeutic value of the more important alcoholic beverages. The results are not overwhelming in any direction, but the majority against the value of beer and wine for medicinal purposes is very decided. That the interpretation of statistics requires great caution is well known to all who have studied their use. One is frequently inclined to agree with the cynical Frenchman who said that nothing can lie worse than figures except facts.

Over fifty thousand question papers were sent out, of which somewhat more than one-half were returned. This is a disappointing point in itself. A stamped addressed envelope was enclosed, and the answering of the question could hardly require ten minutes for most physicians, who must have formed their opinions already, yet many thousands did not take the trouble even to give this time to one of the most important problems that is now before the medical profession of this country. Of those that answered, the general trend is about the same all over the country, but as might be expected the large cities and the well populated industrial sections of the Atlantic slope show a strong feeling in favor of alcoholic beverages, though even in these beer and wine have more opponents than friends.

Whisky finds the greater favor among those who regard alcohol as useful in disease. This is in accordance with sound therapeutics, for if a powerful drug is to be used at all, it is best to use it in as concentrated a form as is fairly safe and in as definite strength as

it can be obtained under ordinary conditions. This is the reason that morphine sulphate is used instead of opium, quinine sulphate instead of bark, strychnine sulphate instead of nux vomica. Whisky represents a strong, nearly pure and fairly constant preparation of alcohol, and when properly aged has a color and aroma that makes it acceptable, indeed, too acceptable, to many. The ideal method of treatment would be to use the so-called "silent spirit" properly diluted, and, if necessary, flavored acceptably, but psychic problems come into play largely in such lines and physicians have never been favorable to getting back to such simple principles as prescribing alcohol for itself alone.

The large majority against beer and wine has some bearing, although not very much upon one of the questions that have arisen under the Volstead Act. Many persons who are favorable to the restriction of the so-called "strong drinks," whisky and brandy and their many fancy mixtures, believe sincerely that the sale of the beverages of low alcoholic content should be permitted, as they are supposed not to lead to drunkenness. The practical problem is, however, how to prevent the sale of the stronger drinks in the places where the weaker ones are on sale. All experience shows that few of those who keep places for the sale of any form of liquor can be trusted to keep within the law when high profit is the reward of breaking it. The saloon has been a focus of law-breaking from the plains of Mesopotamia in the morning twilight of civilization to the present day, and there seems to be no way to exterminate its evils than complete suppression. To permit the sale of light wines and beers is simply to open the door to the free sale of all other beverages of alcoholic content.

The mere figures of the questionnaire do not give the information necessary to determine accurately the feeling of the more authoritative and better-informed of the profession. While the number of replies is disappointingly less than was hoped, there was still a very considerable return, and the opinions are collected from all sections of the country. As noted above, and as might be expected, the larger cities and industrial areas have the strongest tendencies to favor alcohol. This is probably due in considerable measure to business influences, that is, to the profit which results from the sale of such products, for there can be little doubt that in the large cities many doctors are either openly or secretly interested in drug stores, and the

liability of these to favor conditions which will give them a free hand is too evident to be overlooked or minimized.

After all, when we consider the comparative suddenness with which the nation took up prohibition, the rather drastic regulations which the Volstead Act imposed, the large number of persons who look upon alcoholic beverages as harmless in what is called, (without being clearly defined), "moderation," and the long and extended use it has had in medical practice, the narrow escape from negation which the favorite form—whisky—had, and the very heavy vote against the other forms, it appears that a very large number of active and experienced physicians are not convinced that alcohol has sufficient therapeutic value to make it worth while for the nation to run the risk of its sale. We may consider that the JOURNAL has done a great public service and has thrown considerable light upon the national attitude towards the eighteenth amendment.

Another point, however, deserves consideration. As just stated, many physicians (15,218 to be exact) expressed the view that alcohol is not needed in the treatment of disease, for the exclusion of whisky must be regarded as practically the exclusion of alcohol in any form. Yet alcohol is a powerful drug, capable of influencing certain bodily functions, and the most used drugs, such as morphine, mercurials, arsenicals, strychnine, quinine, are all potent and more or less directly poisonous. Is alcohol alone of all the common potent remedies without therapeutic value? If so, one would like to know the reason. The question must arise as to how many of those who pronounced absolutely against all use of alcohol in treatment were influenced by the perils that it carries with it, and felt that the only escape from evils was complete abandonment of the use of the drug. That alcoholic beverages are used to a very great extent when no necessity for such use exists is evident to everyone, but it still seems to be a question as to whether there is a legitimate field for its employment, though it is probable that this field is much more limited than is commonly assumed, and that the extent to which alcohol is abused is largely due to the laxity of the medical profession on the subject.

H. L.

ORIGINAL PAPERS

PERFUMERY AND COSMETICS.

By E. Fullerton Cook.*

In the cultural development of civilization one of the qualities which lifts mankind above other living things is that esthetic sense of mind and spirit which is expressed by the so-called "fine arts."

To those who will to see are given the delight of nature's glories expressed in mountain, sunset and sea, and in a thousand other beautiful pictures. Man, in sculpture, painting, textile arts, and architecture, has also learned to create beauty and to delight in it. For the ear, great artists have sung their melodious dreams, perpetuating them in music for the stirring of the human heart; for the lifting of nations into realms of sheer delight, or inspiring them to noble deeds. The epicurean artist has brought beauty and joy by his creations. Through the touch of silk and velvet, another sense has brought to man an appreciation of the beautiful. Truly it was ordained that the sense of smell should also bring its gifts; for what more delightful than the perfume-laden air which drifts across a field of new mown hay, or the odor of the pine woods, or the faint perfume of a rose or other fragrant flower.

The enjoyment of fine odors has not received the cultivation that is given music, or painting, or the textile arts; yet it plays an important role in the lives of most of us, influencing our actions and giving to us pleasures, or perhaps distress. Perhaps, however, I have but expressed masculine ignorance of the extent to which the feminine mind has studied and applied this art to which "mere man" is so susceptible.

Piesse records the historic fact that in 1770 an act was introduced into the English Parliament which read:

"That all women of whatever age, rank, profession, or degree, whether virgins, or widows, that shall, from and after such Act, impose upon and betray into matrimony any of his Majesty's subjects, by the scents, paints, cosmetic washes, artificial teeth, false hair, Spanish rouge, iron stays, high-heeled shoes, bolstered hips, shall in-

*Delivered as one of a series of Free Popular Lectures at the Philadelphia College of Pharmacy and Science.

cur the penalty of the law now in force against witch craft and like misdemeanors, and that the marriage, upon conviction, shall stand null and void."

What one among us has not felt the power of that distinctive perfume which means a presence or a precious memory? What woman does not know the advantage of associating a romance with a pleasing perfume and then perpetuating its memory by allowing the capture of a glove or lacy handkerchief which bears the perfume?

Some one has said that no sense brings so vividly to mind its associations as that of smell; perhaps each one of you can bear testimony to this truth.

You who cater to the feminine taste in perfumes should know these facts. It is the distinctive odor, obtainable in every form, suitable for use among the lingerie, for perfuming the bath, or perhaps ready to delicately permeate a room with its sweetness, that will please "my lady."

For this is needed the artists' touch, imagination and the product of the master perfumer.

Perfumes are associated in the earliest records with religious ceremonies. It is but natural that the nations of the Far East, even in extreme antiquity, should have offered the sweet-smelling woods and resins of their native land as gifts to their Gods. Thus did they show their homage and respect.

Upon the Egyptian Sphinx which formed the end of a temple, is pictured the king burning incense and offering a libation of oil or ointment.

In Greek mythology men are pictured as obtaining their knowledge of perfumes through the indiscretion of a nymph of Venus.

The early use of perfumes in the worship of the Hebrews is indicated by many passages of the Bible, and in the thirtieth chapter of Exodus, Moses is directed to burn perfumed gums and woods upon an altar, and Aaron to "burn thereon sweet incense every morning"; Moses is directed also to "take sweet spices, stacte and onycha and galbanum, these pure spices with frankincense," and to "make perfume, a confection, after the art of the apothecary, tempered together, pure and holy," and "whosoever shall make like unto that, to smell thereto, shall even be cut off from his people."

India and Arabia have traditionally been the lands of perfumes and the Greeks, and later the Romans also became devotees of the

perfumers' art, soon adapting it to their personal use and carrying the practice to an extreme never since attempted.

In Greece the perfumer's shop was the common meeting place for gossip, and a Greek poet of 350 B. C. wrote:

> "For he t' annoint himself
> Dipped not his finger into alabaster,
> The vulgar practice of a former age;
> But he left fly four doves, with unguents drenched,
> Not of our sort, but every bird a perfume bore,
> Peculiar, and, differing from the rest;
> And they hov'ring around us, from their heavy wings
> Showered their sweets upon our robes and furniture,
> And I—be not too envious, gentlemen,—
> I was bedewed with violet odours."

In the Roman Amphitheatre during a spectacle the air was constantly refreshed by the playing of fountains of perfumed waters.

Perfumed ointments were kept in highly ornamented boxes usually made of alabaster or onyx, and a treatise on the perfumer's art, written by Apollonius, is still extant and gives the sources of supply and the uses of the various odors.

A perfume invented by Frangipanni, one of the earliest Roman nobles, is yet used and bears his name. It is a sachet composed of equal parts of "every known spice," to which is added a weight of orris root equal to the whole, and one per cent. of musk and civet.

It is supposed that the Crusaders brought the perfumer's art to England from Eastern Lands, and by the Elizabethan period it had been developed to a high degree of perfection.

Beau Brummell, the arbiter of English fashion, did not believe in men of fashion using perfumes, and recommended that they send their linen to be washed on Hampstead Heath.

At the close of the nineteenth century, the manufacture of perfumery has been well established; immense laboratories were built in France and England, and their products sold throughout the world.

The raw materials available at that time were all from national sources. A number of animal products had come into use, not for their value as perfumes, but to perform a necessary function in the perfume, namely to retard the lavish expenditure of odor

which the plant or product would otherwise freely give until exhausted.

This class of products are termed "fixatives," and include such substance as musk, ambergris, civet and castor. These materials are still used, although musk and ambergris are scarce and expensive, and synthetic products have successfully replaced them in many instances.

Naturally perfumed woods or flowers represent another class of natural products used throughout the centuries, and still employed for sachets. The most important available today are sandalwood, orris, rose petals, cassie flowers, orange flowers and vertivert.

The Oleoresins of Siam Benzoin, of Oak Moss, Peru Balsam, Tolu Balsam, Galbanum, Orris, Styrax, etc., are another type of preparations which are still used.

The perfume of flowers, fruit and other natural products is due chiefly to a substance called volatile oil. This oil exists in the tissues of the plant, and its extraction is accomplished by one of several ways. Some oils, notably those of the citrus group, including orange and lemon, are found in comparatively large cells, near the surface of the rind, and may be readily removed by one of the following processes:

Sponge Method: The fruit is cut in half, the pulp removed, and the half rind pressed against a sponge which absorbs the liberated oil.

The *"Ecuella process"* is also employed. The fruit is rotated rapidly in a bowl-shaped, tinned-copper vessel, covered inside with small spikes or knives, and the oil which flows from the ruptured oil cells is collected through an opening at the bottom of the bowl.

The latest method of extraction is called the *Thermo-Pneumatic*. The whole fruits are rotated in a cylindrical vessel containing a small amount of water and lined with small spikes, and at the same time steam is admitted or the material heated by the use of a steam jacket. The oil is collected by aspirating or drawing off the vapors through a condenser. Sometimes the oil has been extracted by volatile solvents and separated by means of a vacuum still.

Other volatile oils may readily be obtained by what is termed *"steam distillation."* The oil-bearing portion of the plant, whether fruit, seed, flower or herb is placed in a basket in a still. Water is added and the mixture heated, the vapor being condensed and collected in a Florentine receiver. This vessel is so arranged that the oil may separate and rise to the surface for collection, while the saturated water is drawn off at the bottom. The water thus obtained is sometimes of commercial value, as Orange Flower Water and Rose Water, but, if not salable, it is returned to the still for the next operation, and thus the loss of oil avoided.

The modern still for valatile oils is often adjusted for the use of a vacuum, that the temperature may be reduced.

The more important oils made by this process, and of value to perfumery are Rose, Neroli, Lavender Flowers, Bay, Cardamon, Cinnamon, Rose-Geranium, Jasmine, Orris, Palmarosa, Petit-grain, Sandalwood, Ylang Ylang.

Some volatile oils, especially the more delicate flower perfumes, cannot be obtained successfully by steam distillation, either because the oil exists in minute quantity or is injured by the heat, oxidization or perhaps hydrolysis.

Other processes have therefore been devised. One of these is termed *"Enfleurage"* or the "absorption method."

A mixture of specially selected and highly purified lard and beef fat is spread in a thin layer on a glass plate in a frame, and the fresh flowers, each morning for thirty days, are sprinkled on the fat, the frames being stacked on each other for the intervening time that the odor may be obsorbed. The fat or "pomade" as it is termed is later washed with alcohol to remove the perfume, and these essences were for many years the most important perfume material available.

The flowers best extracted by the enfleurage process are:

Jasmine,
Tuberose,
Jonquil,
Lily of the Valley,
Mignonette (Reseda),
and pomades of Rose, Cassie, Violet, Orange Flowers, Lilac and Heliotrope are also obtainable.

The maceration or infusion process is also employed for this same group, the fresh flowers, each day, being tied in linen bags and macerated in the warmed fat for twenty-four hours, the flowers being removed by centrifuges. The fat should be exposed to at least fifteen different lots of flowers.

This group, which cannot be so satisfactorily heated, are also extracted by cold, *volatile-solvents,* chiefly ether or petroleum ether, and after extraction the solvent is removed by vacuum distillation. By this process are formed what are called "concretes."

The flowers satisfactorily treated by this method are:

Rose,	Mignonette,
Parma Violets,	and sometimes
Victoria Violets,	Carnations,
Orange Blossoms,	Lily of the Valley,
Jasmine,	Heliotrope,
Tuberose,	Elder Flowers,
Jonquil,	Narcissus,
Cassie,	Mimosas.

The volatile-solvent method of extraction removes not only the volatile oil, but also the flower waxes and other inert constituents. If these are now removed, a still more concentrated product results, commercially sold under various names such as "Hyper-essences," "Absolutes," etc., and these are the most expensive perfumery materials now available, the current price for violet being $1700 a pound.

Perfumers who use this class of material are apparently justified in the high price asked for their products.

The cost and variability, in both quality and price, of perfumery products from natural sources, has stimulated the modern organic chemist to search for synthetic perfume materials which would either replace or augment natural perfumes.

The painstaking efforts which have been made to determine the physical characteristics and chemical constituents of important volatile oils, that standards for pure products might be established, and the careful analysis of many other products, in pure research and for commercial purposes, has made available a vast amount of knowledge covering the constituents of these perfumes. With an exact record of the pure chemicals composing the perfume and the

proportion in which they exist in nature, the organic chemist theoretically is only required to prepare the various pure chemicals, mix them in the proportion indicated and produce artificially a rival of nature, which would always be uniform in quality and odor-value, and at a price subject to little fluctuation.

This dream of the synthetic chemist has today been partly realized. Many natural oils have been almost completely duplicated in the laboratory, and the chemist has also discovered chemicals which possess odors practically indentical with those in nature, but entirely unrelated chemically. Artificial musk admirably illustrates this fact.

The perfume chemist has also been able to reproduce many flower odors, which it has not been possible to extract from the flowers because of the minute quantity present; such odors as arbutus and sweet pea are illustrations.

It must not be thought, however, that synthetic perfumes always fully duplicate nature's odors. Often there are minute quantities of constituents which are so illusive that they escape the most careful analysis and others have defied reproduction, but sufficient has been done to fascinate and awe those who make a casual study of modern laboratory creation and to almost drive natural perfumery products from the field.

Taking up these synthetic and natural products side by side, it is possible to obtain interesting comparisons and also to note the available materials and the methods of production.

No strictly scientific odor classification has yet been made, since there seems to be no basis comparable to that of the spectrum for colors, but the following well-known perfume substances and odors have been arranged primarily from the standpoint of the chemical relation of the more important constituent. Grouped with these are all odors which resemble the key-odor but without regard to chemical affiliation, thus really making the classification one of related odors, alphabetically arranged.

The scope of this paper will not permit a complete listing of the constituents of every oil, only the more important having been included. Those who desire a more complete presentation of the chemistry of odorous substances are referred to Parry or Gildemeister and Hoffman.

Both the open and closed chain series of organic chemicals are represented among perfume products and a large variety of chemical structures, such as alcohols, ketones, aldehydes, esters, phenolic compounds, terpenes, etc., are found.

Nitrogen compounds are represented only in the musk-like products and sulphur must be rigidly excluded as even a minute trace will render most substances unfit for use.

ACACIA BLOSSOMS.

Yara.—The methyl ether of beta naphthol, commercially known as "Yara," is a very powerful odor used almost exclusively for perfuming soaps. One-quarter ounce will perfume 100 pounds of soap. This is an excellent illustration of the striking change in odor-value brought about by a slight modification of chemical structure. Betanaphthol, a medicinal chemical, not of itself a perfume, is changed by the introduction of the methyl group, CH_3, into a powerful perfume, not known to exist in nature.

ANISE OIL.

Anethol.—This definite chemical, a phenolic compound, is the chief constituent in the Oils of Anise and Star Anise.

ARBUTUS.

This odor, such a source of delight in the spring to those who have the time to search for the delicate blossoms hiding close to the ground, has been reproduced synthetically and is a grateful perfume.

BAY OIL.

This oil is not produced synthetically but one of its most important constituents is the definite chemical *Eugenol* found also in clove and other volatile oils.

This oil gives the distinctive odor to "*Bay Rum.*"

BERGAMOT OIL.

Important pure chemical constituents of this citrus oil are:

Limonene, a terpene, also found in the oils of Lemon, Orange, Caraway, etc., also the alcohol *Linalol* $C_{10}H_{17}OH$, and

Linalyl Acetate, which is likewise found in lavender oil, and used in the artificial production of the oils of bergamot and lavender. Linalyl acetate also occurs in the oils of ylang ylang, petit grain, neroli, jasmine, gardenia, and others.

BITTER ALMOND OIL.

The natural oil largely consists of pure

Benzaldehyde, C_6H_5CHO, a chemical substance which may be produced synthetically.

Nitrobenzene, $C_6H_5NO_2$, *Oil of Mirbane.* It is not chemically identical with benzaldehyde but has an odor resembling Bitter Almond and is used as a cheap soap perfume.

CARNATION.

A substance known as

Iso-eugenol is found in small amounts in the oil of ylang ylang and nutmeg. It possesses a powerful carnation-like odor and is essential in the production of artificial carnation or *"œillet."*

Another modification of eugenol,

Methyl-eugenol, is found in the oils of calamus, cassie and bay. It possesses a distinct carnation-like odor and is used in manufacturing perfumes of the carnation type.

Caryophyllene, $C_{15}H_{24}$, obtained from the oils of cinnamon, clove and other oils, possesses an odor resembling carnation.

CASSIE OIL (resembling violets).

This oil from Acacia Farmesiana possesses an odor resembling the violet. It is obtainable, for perfumery, chiefly in the form of a pomade, although the oil is a commercial article.

It has been carefully analyzed and shown to contain the following definite chemical constituents:

Farnesol,
Geraniol,
Linlol,
Benzyl alcohol,

Methyl salicylate,
Adecylic aldehyde,
A carminic aldehyde,
An anisic aldehyde,
also a ketone of a violet-like odor.

A synthetic cassie is obtainable.

CINNAMON OIL.

In addition to

Cinnamic aldehyde, which is the most important constituent in the oils of cinnamon and cassia, there is found

Caryophyllene, a sesquiterpene, $C_{15}H_{24}$, having an odor resembling carnations.

CLOVE OIL.

The characteristic constituent in the oils of clove, cinnamon leaf, bay, and pimento is

Eugenol, $C_{10}H_{12}O_2$. This substance is chiefly important as the starting point for synthetic "vanillin."

GARDENIA.

Methyl Anthranilate, an ester, is one of the constituents of this oil and possesses the characteristic odor of the synthetic perfume resembling gardenia.

HAWTHORN.

Anisic Aldehyde—also known as "aubepine," is the basis for the above synthetic odor.

HELIOTROPE.

Heliotropin (piperonal). The methylene ether of protocatechuic aldehyde, a white crystalline substance, possesses a powerful odor resembling heliotrope and is the basis for synthetic heliotrope perfumes. It is an excellent blender and fixative.

HONEYSUCKLE.

The odor sold as *Honeysuckle* is prepared synthetically.

HYACINTH.

Phenyl Propyl Alcohol possesses a soft, heavy odor of the hyacinth type. The odor of *Cinnamic Alcohol* is also similar to hyacinth.

Another substance having a hyacinth-like odor is

Phenylacetic Aldehyde. It is not found naturally but is used in the synthetic production of a hyacinth odor.

Phenyl ether (Diphenyl Oxide) also resembles hyacinth and is much used in synthetic perfumery.

JASMINE OIL.

The analysis of natural jasmine oil, according to Hesse and Miller, shows about the following composition:

Benzyl Acetate	65.	parts
Linalyl	7.5	"
Benzyl alcohol	6.	"
Linalol	15.5	"
Indol	2.5	"
Jasmine (*a ketone*)	3.	"
Methyl anthranilate	0.5	"

Other entirely different chemical substances possess a jasmine-like odor, as

Brom-styrolene ($C_6H_5.CH.CHBr$)

Styrolene alcohol (or phenyl-glycol-methylene-acetol) $C_6H_5.CH(OH)CH_2OH$. Secondary styrolyl acetate $C_6H_5.CH(O.CO.CH_3)CH_3$ and are all used for making synthetic jasmine.

JONQUILLE.

This odor is obtainable from natural sources through the enfleurage process and is also made synthetically.

LABDANUM RESIN.

A ketone obtained from this resin,

Acetphenone, $C_6H_5.CO.CH_3$, is now made synthetically. It possesses a powerful odor and is used chiefly in soap perfumery.

LAVENDER FLOWER OIL.

The *alcohol Linalol,* $C_{10}H_{17}H$ and

Linalyl Acetate are important constituents of this oil and constitute the basis for the synthetic oil.

LEMON OIL.

This is a natural product, produced in enormous quantities in lemon-growing countries. It contains

Limonene, a terpene having the formula $C_{10}H_{16}$, which represents the largest proportion of the oil.

Linalol, an alcohol, $C_{10}H_{17}OH$, is also present and

Citral represents from 4 to 6 per cent. of the oil and gives it the characteristic flavor.

Citral is obtained artificially by oxidizing geraniol and is also extracted from lemon grass oil.

LILAC.

This odor is one of the triumphs of the synthetic chemist, as it is not obtainable from natural sources and is one of the most popular and pleasing of perfumes.

Terpineol, a terpene alcohol, $C_{10}H_{17}.OH$. It is the basis for most of the perfumes of the lilac type.

Various modifications are sold under the names "*Muguet,*" *Syringol, lilacine* and *synthetic gardenia.* It is often blended with geranium oil, heliotropine, ylang ylang, sandalwood and rose. Heat, acid and alkali do not appreciably affect it.

LILY OF THE VALLEY.

This popular perfume is only obtainable synthetically and although it represents a compounded product the basis is the alcohol terpineol.

MAGNOLIA.

This is again a purely synthetic perfume.

Ethyl acetate $C_2H_5.C_2H_3O_2$ is found in small amounts in the natural magnolia.

MEADOW SWEET.

Salicylic aldehyde is said to be the basis for this perfume.

NARCISSUS.

Phenylacetic aldehyde is said to be the basis for the synthetic narcissus perfumes.

NEROLI OIL (ORANGE FLOWERS.)

The odor of orange flowers has long been highly prized as a perfume. The unmodified odor of the flowers is obtainable from pomades, concretes, absolutes and from Orange Flower Water. The distilled oil known as Oil of Neroli, possesses a valuable but distinctly altered odor. This oil is the most pronounced odor in "Cologne Water" which has been a popular perfume for more than a hundred years.

Synthetic Neroli is also obtainable and the oil has been shown to contain the following pure chemicals and possibly others:

Indol, C_8H_7N, found in the oils of orange and jasmine flowers.

Phenyl-ethyl alcohol $C_6H_5CH_2.CH_2OH$

Methyl Anthranilate—The methyl ester of ortho-amido-benzoic acid.

Ethyl Anthranilate—Sweeter and better than the methyl ester.

Octyl Aldehyde—$CH_3(CH_2)_6CHO$—A natural constituent.

Other substances have been found to resemble the odor of orange flowers and are much used in synthetic perfumery.

Phenyl ether (Diphenyl oxide) is one of these.

Bromelia—The ethyl ether of beta-naphthol, is a powerful odor resembling orange flowers and used in perfuming soap. One-quarter ounce will perfume 100 pounds of soap.

NEW MOWN HAY.

The basis of this long popular perfume is a delightfully odorous substance found naturally in the tonka bean, in newly cut grass, and also made synthetically.

It serves also as a fixative.

ORANGE OIL.

This valuable oil is obtained from the natural source, the rind of the orange.

Limonene a terpene $C_{10}H_{16}$ constitutes the larger part of the oil.

ORCHIDS.

The perfume sold under this title is purely synthetic and

Amyl Salicylate is the base usually employed. Perfumes on the "Orchid" type are also sold as *"orchidae,"* *trefle,* or *trefoil,* etc.

ORRIS.

"Orris Root" as it is commercially known, the rhizome of *Iris florentina,* possesses a pleasing odor resembling violets, and was for many years the most important artificial violet odor.

Ground or powdered Orris is today the basis for most sachets. The oil and the ketone *irone,* obtained from the oil and also produced synthetically, being isomeric with ionone, is yet an important factor in producing modern violet perfumes.

PALMAROSA OIL.

Geraniol, $C_{10}H_{17}OH$, also an important constituent in Oil of Rose is found in this oil.

PINE OIL.

This pleasantly smelling oil, suggesting the pine forests, is used in the industries and in medicine and has also found a place in perfumes of the type used for refreshing the air of rooms where cheapness and refreshing effects are essential.

Some of its chemical constituents are:

Pinene, Camphene and *Sylvestrene,* terpenes having the formula $C_{10}H_{16}$.

Sylvestrene is also found in terpentine.

PINE NEEDLE OIL.

This oil is very similar to Pine Oil.

Bornyl Acetate is an important constituent.

ROSE.

Rose, for centuries, has been one of the most valued perfumes and fortunately the natural course has provided materials for the perfumer. Rose petals, carefully dried, and preserved in an ornamental jar is the chief odorous substance used in the perfume

known as *"potpourri."* The oil has long been distilled and is usually known as *"Otto of Rose."* The distilling of Rose Oil in Bulgaria, from where the largest amount has long been obtained, is today a government monopoly. The roses are grown for the oil and an acre yields about 100 pounds of roses each day for about three weeks.

In Southern France the roses are grown primarily for the flower market but much Oil of Rose is distilled.

In Bulgaria it is said that it requires about 3000 pounds of roses to produce one pound of oil. In France from 10,000 to 20,000 pounds of roses to produce one pound of oil.

The natural rose perfume is also available from pomads and as Rose Water. The Oil of Rose has been carefully analyzed and shown to consist of solid stearoptenes, representing about 33 per cent. of the oil, complex alcohols, about 50 per cent. and esters. A typical analysis is as follows:

Stearoptenes (paraffin hydrocarbons, $C_{16}H_{34}$)	33.5 parts
Geranyl acetate,	1.6 parts.
Geranyl Phenylacetate Citronellol, $C_{10}H_{19}OH$ Geraniol, $C_{10}H_{17}OH$ Rhodinol, $C_{10}H_{19}OH$ Phenyl ethyl alcohol, $C_6H_5.CH_2.CH_2OH$ Nerol Fornesol Ethylic alcohol Linalol, $C_{10}H_{17}OH$	All alcohols 50.0 parts

These definite chemicals have all been made synthetically or separated from other oils and enter into synthetic Rose products.

Other chemical substances possess roselike odors and are used in preparing synthetic Oil of Rose. Some of these are:

Octyl Alcohol
Octyl aldehyde
Citronellyl Acetate
Phenyl-ethyl Propionate
Geranyl Butyrate used chiefly for perfuming soaps.

ROSE GERANIUM OIL.

This oil consists chiefly of geraniol, 27 to 58 per cent., Citronellol, 42 to 73 per cent. Also Linalol.

The larger the proportion of Citronellol, the better the grade.

The following additional chemical substances are of interest in connection with Geranium Oil:

Geranyl formate is not found naturally in the oil, but has a sweet, rose-geranium-like odor.

Citronellyl Acetate is used in blending the synthetic oil.

The basis of most synthetic Geranium Oils is

Phenyl ether (Diphenyl oxide), $C_6H_5.O.C_6H_5$.

ROSEMARY OIL.

One of the constituents of this oil is

Bornyl Acetate.

SANTALWOOD OIL.

This oil, used in small amounts, chiefly as a fixative, contains

Santalene, a sesqueterpene, $C_{15}H_{24}$, and

Santalol, an alcohol, $C_{15}H_{24}O$.

SWEET PEA.

This delicate odor has been admirably reproduced synthetically.

TUBEROSE.

The odor of the tuberose does not pre-exist in the plant as a volatile oil, but is the result of chemical action upon constituents, among which are Benzyl Alcohol and Menthyl Anthranilate.

VANILLA.

Vanilla is usually thought of as a flavoring substance, but the crystallizable aldehyde, vanillin, present in the beans, possesses odor value and excellent fixative qualities.

Vanillin ($C_8H_8O_3$) methyl protocatechuic aldehyde, besides occurring naturally in the vanilla bean (about 2 per cent.) is also found in benzoin and the balsams of Peru and Tolu. The commercial product, however, is prepared artificially by various processes, the most important being the oxidation of eugenol from oil of clove.

VERBENA OIL.

This oil has been used as a cheap form of perfume.

VERTIVERT.

Both the oil and the ground root have been used in perfumery.

VIOLET.

The violet perfume is the most popular of odors, but Violet flowers contain so small an amount of volatile oil that when obtained from natural sources it becomes the most expensive perfume material known. According to Isokovics one pound of fresh flowers cost in the producing districts of France from 25 to 35 cents and four pounds of flowers yield only one grain of oil when all non-odorous constituents are excluded. This would make the true flower oil cost over $7000 a pound and it is interesting to note that in a current price list, a concentrated extract of violet flowers is quoted at $1700 per pound. It can therefore be seen that the discovery of a synthetic product possessing the true violet odor was a valuable contribution to perfumers' art.

This substance is known as Ionone and a number of modifications have been developed.

Ionone. From the standpoint of modern perfumery, this ketone is considered essential for the production of violet odors.

It is now marked in two forms known as Alpha-ionone and Beta-ionone. *A-ionone* is said to have a sweeter and more penetrating odor, rather resembling orris, while the *b-ionone* is more like the true violet flowers. They are very powerful and must be largely diluted, at least one to one thousand and blended with other substances to produce the desired effect.

Irone. A ketone naturally present in Orris Oil, is isomeric with ionine and has the formula $C_{13}H_{20}O$. It possesses an odor resembling violet and is used in violet perfumes.

WINTERGREEN OIL.

This oil, chiefly used as a flavor, contains about 99 per cent. of *Methyl Salicylate,* a definite chemical, $CH_3C_7H_5O_3$. The *Oils of Betula and Sweet Birch* contain about the same amount of methyl salicylate and the Pharmacopœia considers the three products identical from the therapeutic standpoint.

Methyl Salicylate is prepared synthetically on a large scale.

YLANG YLANG OIL.

This oil is largely obtained from the Philippine Islands, Java, and Southern Asia, and the name means "flower of flowers."

It possesses perfume value and analysis shows it to contain

Linalol,
Geraniol,
Codinene,
Methyl ether of eugenol,
" " " iso-eugenol,
Methyl benzoate
" salicylate,
Benzyl acetate
" benzoate,
" alcohol, and
Methyl anthranilate.

It is prepared synthetically.

"ORIENTAL ODORS."

A type of odor which is intense, heavy, and lingering, containing such substances as santalol, cedrol, patchouli alcohol, guaiol, is referred to as an oriental odor. Another name applied to this class of odors is "Trefle." These odors are all compounded and do not represent any natural flower. A number of samples are displayed, which represent this class.

COMPOUNDED ODORS.

In addition to the well-known flower odors as rose, lilac, violet, etc., the perfumer has developed blends of odorous substances to which a fanciful name is attached.

This tendency has been very marked of recent years and special names like "Djer-Kiss," "Ideal," "Adoration," "Azurea," "Mary Garden," etc., are being controlled and extensively advertised.

The possibility for new odors in this class of perfumes is unlimited with the hundreds of natural and synthetic odors made available for the perfumer.

Samples of some of these are shown.

FIXATIVES.

As already mentioned, the perfumer has found it necessary to add to perfumes certain substances which lessen the volatility of the floral odors and increase the permanency of the product. These substances in themselves often possess a disagreeable odor, but are used in small amounts and are unnoticed in the finished perfume.

Some of the substances of this character are of animal origin, as musk, civet, castor and ambergris, others are from vegetable sources, as gum-resins and balsams, while still others are synthetic, as heliotropin, vanillin, coumarin, synthetic musk, civet, etc.

Musk. Natural Musk is a dried secretion obtained from the Musk deer. It is excessively costly and difficult to procure in pure form as the animal from which it is obtained frequents the mountain heights of interior Asia, chiefly Thibet, and is almost extinct because of the many years that it has been hunted. Today it is quoted at from $50 to $80 an ounce and recent purchases of the tincture cost $9 for four fluid ounces.

Fortunately the odor and fixative value, which apparently is due to a ketone, has been largely duplicated by the chemist but by an entirely different chemical entity.

Artificial Musk. The true Musk ketone is without the presence of nitrogen, but several nitrogenous compounds have been produced which strongly resemble the musk odor.

The chemical constituents of some of the artificial musks are as follows:

Tri-nitro-butyl xylene (*"xylene musk"* or *"Musk-Baur"*).
Butyl-xylene-propyl ketone (*"ketone musk"*).
Dinitro-tertiary-butyl-xylene-aldehyde (*"aldehydemusk"*).
Dinitro-tertiary-butyl-xylene-cyanide (*"cyanide musk"*).
Musk Ambrette or *Dinitro-butyl-meta-cresol-methyl ether* is also a substance having a musk-like odor.

Ambergris—The substance which has long been prized as a fixative is an animal decomposition product ejected by the Sperm Whale and usually found floating on the ocean. The better qualities are worth at least $25 an ounce.

A practically identical synthetic product has been produced which can be sold for $50 a pound.

Civet—A secretion obtained from the civet cat, is valuable as a fixative. The natural product is obtainable at a reasonable price, as the animal from which it is procured is domesticated in the East Indies and the secretion may be secured by scraping the secretion gland.

Synthetic Civet is also available and is sold under the name of "Civettine."

Castor—A secretion product resembling civet, obtained from the beaver. This product was at one time extensively used in the practice of medicine but has fallen into disuse.

Storax, a balsam for many years obtained from the oriental sweet-gum (Liquidambar orientalis) but now also commercially available from the "sweet-gum" tree of America (Liquid-ambar styraciflua) is used as a fixative in perfumery. That portion of Storax which gives it value in perfumery consists of the cinnamic acid esters of ethyl, benzyl, phenyl, propyl and cinnamyl alcohols also phenyl propyl alcohol, cinnamyl alcohol and vanillin.

Balsam of Peru consists chiefly of benzyl cinnamate and benzoate, free benzoic and cinnamic acids. An alcohol named peruviol and small amounts of fornesol, cinnamic alcohol and vanillin.

Balsam of Tolu consists chiefly of a terpene, phellandrene, benzyl benzoate, benzyl cinnamate and fornesol.

Amyl Benzoate and *Benzyl Benzoate* are among the best known fixatives and the latter is also used in perfumery as a solvent for artificial musk, the so-called *"musk oil"* being a solution of artificial musk in benzyl benzoate.

Heliotropin, vanillin and *coumerin* all possess valuable fixative as well as perfume qualities. These have all been referred to elsewhere in this paper and details given.

Fruit Flavors.

Many artificial fruit flavors have been marketed having odors and flavors similar to those of the natural fruit. To most people, however, the results have been disappointing. It is interesting to note that at the present time Dr. Frederick W. Power, a research chemist of international reputation is engaged in the U. S. Bureau of Chemistry, upon a study of the composition of important fruit flavors.

The results of this work is being published in a series of Government Bulletins and this investigation has already made it possible to greatly improve some artificial fruit flavors and promises gratifying and valuable results.

In preparing this review of the perfumery industry, the following books have been consulted:

"Chemistry of Essential Oils and Artificial Perfumes" (Parry).

"Volatile Oils" (Gildemeister and Hoffman).

"Cosmetics" (Koller).

"The Art of Perfumery" (Piesse).

"Synthetic Perfumes and Flowers" (Isakovics).

STUDIES IN EXTRACTION.

II. The Rate of Extraction of Cascara Sagrada.

By James F. Couch.

In an earlier paper [1] I described the procedure and reported the results obtained in a determination of the rate at which Phytolacca decandra is extracted with the menstruum (diluted alcohol) used in the process of the U. S. P. 8. Following that investigation a sample of cascara sagrada was extracted, the percolate was collected in fractions and these were analyzed for alcohol content and extract, and the specific gravity was determined.

Certain innovations were introduced into the general procedure which made it somewhat different from that followed in the case of Phytolacca, chief of which were: The menstruum (40 per cent. alcohol by volume) was all mixed at one time instead of in five-gallon lots as was done with the Phytolacca. This procedure ensured a non-varying menstruum which the former method did not. This detail was important because it was intended that a careful study of the changes in alcoholic content of the percolate should be made and possible error due to slight differences in the menstruum was thereby avoided. Another innovation was the change in the collection of the fractions. In the former experiment the percolate was collected in equal fractions of one gallon each until the drug was exhausted; in this study the first five gallons of percolate were collected in one-gallon lots, the next ten gallons were collected in two-gallon lots making five samples in all, and the remaining twenty gallons of

[1] This Journal, Vol. 93, pp. 419-26 (1921).

percolate which were collected were taken in lots of five gallons each, or four samples. The total number of samples of percolate was, therefore, fourteen.

Mathematical treatment of the data obtained from these samples similar in nature to that applied to the data from Phytolacca yielded the same sort of results. There was the same progressive variation, either a numerical increase or a decrease, and no constant was obtained. The unknown factors which operated with Phytolacca evidently played a rôle in the extraction of this cascara.

The results obtained (see Table I) agree with those from Phytolacca which indicates that the general course of extraction is qualitatively the same in both drugs. There is the same rapid initial extraction, the regularity, and the retardation. When fifteen gallons of percolate had been collected, that is when 300 ml. of menstruum for each 100 gm. of drug had percolated through, the quantity of extract removed was 95.34 per cent. of the total extract obtained. The cascara yielded 31.93 per cent. of extract or slightly less than the Phytolacca (32.75 per cent.), and, with the latter drug, an equivalent quantity of menstruum removed 97 per cent. of the total extract. Consequently the cascara is a trifle more difficult to extract.

The alcoholic content of each of the samples was determined and the results were very interesting. The minimum amount occurred in the first sample which contained 33.78 per cent. The increase in alcoholic content was slow and did not reach the maximum until the ninth sample. Thenceforward the alcoholic content of the percolate was essentially constant. It may be noted here that this change in content of alcohol is not due solely to the decrease in quantity of extract, but is also due to variation in the alcoholic content of the solvent inasmuch as the first portions of percolate contain the drug moisture which dilutes the menstruum.

Another interesting result was the extract content of sample 2 which was larger than that of sample 1. This recalls the similar case described by Lloyd.[2] It may be explained by the assumption[3] that during the maceration a part of the first fraction has saturated the cotton or excelsior at the bottom of the percolator and so has been quite out of contact with the drug.

[2] This Journal, Vol. 50, p. 438 (1878).
[3] This Journal, Vol. 92, p. 792 (1920).

EXPERIMENTAL.

A quantity of cascara was purchased on the open market, identified, and ground to a coarse powder. 18.9 kg. of this drug was percolated according to the directions in the U. S. P. 8 for fluidextract of cascara. The drug was thoroughly moistened with the menstruum in a mechanical mixer and the whole was packed firmly and evenly in a galvanized iron percolator of about twenty-five gallons capacity. The percolator was set in place and enough menstruum was added to the drug to saturate it and leave a stratum above. When a few drops of percolate appeared at the lower orifice the outlet was closed, the percolator was tightly covered and the drug was allowed to macerate for exactly forty-eight hours. Percolation was then commenced and the rate of flow of percolate was adjusted so that one gallon was obtained in about one and one-half hours. The percolation was discontinued at 5.30 P. M. each day and was recommenced at 8 A. M. the following morning; the date of starting was so chosen that a Sunday did not occur to interrupt the percolation.

The fractions of percolate were collected in clean bottles connected by a rubber tube with the percolator. The whole fraction was thoroughly mixed and a sample was taken for analysis.

The extreme variations of temperature during the process were 21° C. and 27° C.

Fresh menstruum was added to the percolator continually to replace that percolated out so that the stratum above the drug was fairly constant.

The specific gravity, alcohol and extract content of the samples was determined by the methods adopted in the study on Phytolacca.

The data obtained is recorded in Table I.

TABLE I.

Sample No.	Quantity Gals.	Extract per 100 ml. Gm.	Corrected Extract Gm.	S. G. of Percolate.	Abs. Alc. by Vol.	% of Total Extract.
1	1	19.470	19.470	1.0190	33.78	12.18
2	1	19.684	19.684	1.0180	33.94	12.32
3	1	18.116	18.116	1.0150	34.30	11.34
4	1	16.816	16.816	1.009	34.64	10.77
5	1	15.504	15.504	1.004	35.16	9.704
6	2	12.304	24.608	0.9970	35.80	15.40

Sample No.	Quantity Gals.	Extract per 100 ml. Gm.	Corrected Extract Gm.	S. G. of Percolate.	Abs. Alc. by Vol.	% of Total Extract.
7	2	8.848	17.696	0.9837	36.90	11.08
8	2	5.456	10.912	0.9736	38.76	6.83
9	2	3.120	6.240	0.9653	39.76	3.906
10	2	1.640	3.280	0.9599	39.76	2.053
11	5	0.700	3.500	0.9556	39.80	2.191
12	5	0.376	1.880	0.9542	39.76	1.177
13	5	0.236	1.180	0.9537	39.72	0.738
14	5	0.176	0.880	0.9529	39.72	0.550

SUMMARY.

1. The extraction of the official bark of cascara sagrada proceeds regularly with diminishing velocity.

2. The factors which determine the rate of extraction are those found in the study of Phytolacca.

3. A quantity of percolate equivalent to 300 ml. per 100 gm. of drug extracted 95 per cent. of the total extract. Cascara is somewhat more difficult to extract than is Phytolacca.

4. The change in alcoholic content of the percolate was studied quantitatively and the results are reported.

ABSTRACTED AND REPRINTED ARTICLES

PHARMACEUTICAL ETHICS.*†

A Historical Review of the Subject With Examples of Codes Adopted or Suggested at Different Periods, Together With a Suggested Code for Adoption by Present-Day Associations.

By Charles H. Lawall.[1]

Ethics is the science of human duty. A code of ethics is a carefully formulated system of principles or rules of practice for the guidance of a particular group of individuals, such as the members of a profession.

The Mosaic law is a code of ethics in the broadest sense as applied to humanity at large.

The development of codes of ethics is an indication of the evolution and growth of moral consciousness. Ethics and morality are not always synonymous; neither are ethics and legality. "Right" and "wrong" are terms which have different meanings and interpretations at different periods.

The necessity for specific principles for the guidance of individuals having common interests, in addition to the tenets of religion and morality, has been recognized from the earliest historical periods. Probably the most ancient code of professional ethics is the Hippocratic Oath, which has been in existence for about 2500 years, and which is an eminently suitable starting point for a discussion of the subject. One of the several translations is as follows:

"THE HIPPOCRATIC OATH.

"I swear by Apollo the physician, and Aesculapius, and Hygeia, and Panacea, and all the gods and all the goddesses—and I make them my judges—that this mine oath and this my written engagement I will fulfil as far as power and discernment shall be mine.

*Presented before Section on Education and Legislation, A. Ph. A., New Orleans meeting, 1921.

†Reprinted from the *Journal of the American Pharmaceutical Association*, Vol. X, Nos. 11 and 12. November and December, 1921.

[1] Dean of the Philadelphia College of Pharmacy and Science.

"Him who taught me this art I will esteem even as I do my parents; he shall partake of my livelihood, and, if in want, shall share my goods. I will regard his issue as my brothers and will teach them this art without fee or written engagement if they shall wish to learn it.

"I will give instruction by precept, by discourse, and in all other ways to my own sons, to those of him who taught me, to disciples bound by written engagements and sworn according to medical law, and to no other person. So far as power and discernment shall be mine, I will carry out regimen for the benefit of the sick and will keep them from harm and wrong. To none will I give a deadly drug, even if solicited, nor offer counsel to such an end; likewise to no woman will I give a destructive suppository; but guiltless and hallowed will I keep my life and mine art. I will cut no one whatever for the stone, but will give way to those who work at this practice.

"Into whatsoever houses I shall enter I shall go for the benefit of the sick, holding aloof from all voluntary wrong and corruption, including venereal acts upon the bodies of females and males, whether free or slaves. Whatsoever in my practice or not in my practice I shall see or hear amid the lives of men which ought not to be noised abroad—as to this I will keep silence, holding such things unfitting to be spoken.

"And now if I shall fulfil this oath and break it not, may the fruits of life and art be mine, may I be honored of all men for all time; the opposite if I shall transgress or be forsworn."

The foregoing is a splendid example of exalted idealism, couched in virile, dignified language, and applicable to present day conditions, with minor changes.

In the twelfth century A. D. there lived a Jewish physician and teacher named Maimonides, who is ranked by medical historians as the greatest Jew after Moses. He was born at Cordova, Spain, then under Arabic domination, and his Arabic name was "Abu Amran Musa Ben Maimum Obaid Alla el Cordovi."

He contributed the next great landmark in the literature of professional ethics in the shape of a combined oath and invocation.

"THE OATH AND PRAYER OF MAIMONIDES.

"Thy Eternal Providence has appointed me to watch over the life and health of Thy creatures. May the love for my art actuate me at all times; may neither avarice, nor miserliness, nor the thirst

for glory, or for a great reputation engage my mind; for the enemies of Truth and Philanthropy could easily deceive me and make me forgetful of my lofty aim of doing good to Thy children.

"May I never see in the patient anything but a fellow creature in pain.

"Grant me strength, time and opportunity always to correct what I have acquired, always to extend its domain; for knowledge is immense and the spirit of man can extend infinitely to enrich itself daily with new requirements. Today he can discover his errors of yesterday and tomorrow he may obtain a new light on what he thinks himself sure of today.

"O God, Thou hast appointed me to watch over the life and death of Thy creatures; here am I ready for my vocation.

"And now I turn unto my calling:

O stand by me, my God, in this truly important task;
Grant me success! For—
Without Thy loving counsel and support,
Man can avail but naught.
Inspire me with true love for this my art
And for Thy creatures,
O, grant—
That neither greed for gain, nor thirst for fame, nor vain ambition,
May interfere with my activity.
For these I know are enemies of Truth and Love of men.
And might beguile one in profession,
From furthering the welfare of Thy creatures.
O strengthen me.
Grant energy unto both body and the soul
That I might e'er unhindered ready be
To mitigate the woes,
Sustain and help
The rich and poor, the good and bad, enemy and friend,
O let me e'er behold in the afflcted and the suffering,
Only the human being."

Both of these refer particularly to medical practice. The earliest rules for guidance of pharmacists which I have been able to find, occur in the sixteenth century. Bulleyn, a cousin of Queen Anne Bulleyn and a prominent English apothecary of that century, is authority for the following rules for the guidance of the apothecaries of his day.

"The apothecary must first serve God; forsee the end, be cleanly and pity the poor. His place of dwelling and shop must be cleanly to please the senses withall. His garden must be at hand with plenty of herbs, seeds and roots. He must read Dioscorides. He must have his mortars, stills, pots, filters, glasses, boxes, clean and sweet. He must have two places in his shop, one most clean for physic, and the base place for chirurgic stuff. He is neither to increase nor diminish the physician's prescription. He is neither to buy nor sell rotten drugs. He must be able to open well a vein, for to help pleurisy. He is to meddle only in his own vocation, and to remember that his office is only to be the physician's cook."

Some of these rules are still worthy of consideration in a modern code of ethics. It is particularly interesting to note, however, the viepwoint of that day as regards the relative importance of medicine and surgery, for in a modern store, the "chirurgic stuff" is given the cleanest place and not the one which is "base."

The seventeenth century saw the famous battle between the Galenists and the Paracelsists, and the development of guilds and societies of apothecaries, whose records are not easily accessible or widely copied. One item of collateral interest from this period is the oath of the journeymen apothecary of Germany, which is referred to as follows:

"Every journeyman apothecary shall take an oath that he will faithfully serve, not only his master, but also the members of the community at large. That he will prepare all medicines 'secundum artem,' and of pure drugs, whether they be such as are annually examined by the authorities or not. That he will dispense no poison, opiate or emmenagogue without the knowledge of the master, or endanger the life of any one by his carelessness. That he will not deliberately change a physician's prescription, and will abstain from excessive indulgence in intoxicating drinks and will at all times set a good example to the apprentice. That he will not leave the shop without the knowledge of the master, and particularly not absent himself at night. That he will be devoted to his master, to the *visitatori medico,* and to each of the doctors of the incorporated Collegio Medico. He shall swear that he will do all this according to his best ability."

The eighteenth century saw the rise of proprietary medicines and some of our well-known and respectable preparations of the pres-

ent pharmacopœias of the world originated as secret formulas or prescriptions of eminent physicians during this period, in which little of constructive value to the ethics of the calling seems to have come down to us.

In the early part of the nineteenth century, pharmaceutical education in America had its beginning in the founding of the Philadelphia College of Pharmacy in 1821.

The first code of ethics of this organization, which is the earliest code of pharmaceutical ethics that has a direct connection with and applicability to present day practice, was adopted in 1848, and reads as follows:

"A CODE OF ETHICS ADOPTED BY THE PHILADELPHIA COLLEGE OF PHARMACY.

"Pharmacy being a profession which demands knowledge, skill, and integrity on the part of those engaged in it, and being associated with the medical profession in the responsible duties of preserving the public health, and dispensing the useful though often dangerous agents adapted to the cure of disease, its members should be united on some general principles to be observed in their several relations to each other, to the medical profession, and to the public.

"The Philadelphia College of Pharmacy being a permanent, incorporated institution, embracing amongst its members a large number of respectable and well educated apothecaries, has erected a standard of scientific attainments, which there is a growing disposition on the part of candidates for the profession to reach; and being desirous that in relation to professional conduct and probity, there should be a corresponding disposition to advance, its members having agreed upon the following principles for the government of their conduct:

"1st. The College of Physicians of Philadelphia having declared that any connection with, or monied interest in apothecaries' stores, on the part of the physicians, should be discountenanced; we in like manner consider that an apothecary being engaged in furthering the interests of any particular physician, to the prejudice of other reputable members of the medical profession, or allowing any physician a percentage or commission on his prescriptions, as unjust toward that profession and injurious to the public.

"2nd. As the diagnosis and treatment of disease belong to the province of a distinct profession, and as a pharmaceutical education does not qualify the graduate for these responsible offices; we should, where it is practicable, refer applicants for medical aid to a regular physician.

"3d. As the practice of Pharmacy can only become uniform, by an open and candid intercourse being kept up between apothecaries, which will lead them to discountenance the use of secret formulæ, and promote the general use and knowledge of good practice, and as this College considers that any discovery which is useful in alleviating human suffering, or in restoring the diseased to health, should be made public for the good of humanity and the general advancement of the healing art—no member of this College should originate or prepare a medicine, the composition of which is concealed from other members, or from regular physicians.

"Whilst the College does not at present feel authorized to require its members to abandon the sale of secret or quack medicine, they earnestly recommend the propriety of discouraging their employment, when called upon for an opinion as to their merits.

"4th. The apothecary should be remunerated by the public for his knowledge and skill, and his charges should be regulated by the time consumed in preparation, as well as by the value of the article sold; although location and other circumstances necessarily affect the rate of charges at different establishmnts, no apothecary should intentionally undersell his neighbors with a view to his injury.

"5th. As medical men occasionally commit errors in the phraseology of their prescriptions, which may or may not involve ill consequences to the patient if dispensed, and be injurious to the character of the practitioner; it is held to be the duty of the apothecary, in such cases, to have the corrections made, if possible, without the knowledge of the patient, so that the physician may be screened from censure. When the errors are of such a character as not to be apparent, without the knowledge of circumstances beyond the reach of the apothecary, we hold him to be blameless in case of ill consequences, the prescription being his guarantee, the original of which should always be retained by the apothecary.

"6th. Apothecaries are likewise liable to commit errors in compounding prescriptions—first, from the imperfect handwriting of the

physicians; secondly, owing to the various synonyms of drugs in use, and their imperfect abbreviations; thirdly, from the confusion which even in the best regulated establishments, may sometimes occur, arising from press of business; and fourthly, from deficient knowledge or ability of one or more of the assistants in the shop, or of the proprietor—

"We hold that in the first three instances named, it is the duty of the physician to stand between the apothecary and the patient, as far as possible; and in the last that he should be governed by the circumstances of the case—drawing a distinction between an error made by a younger assistant accidentally engaged, and a case of culpable ignorance or carelessness in the superior.

"7th. As the apothecary should be able to distinguish between good and bag drugs, in most cases, and as the substitution of a weak or inert drug for an active one, may, negatively, be productive of serious consequences—we hold that the intentional sale of impure drugs or medicines, from motives of competition, or desire of gain, when pure articles of the same kind may be obtained, is highly culpable, and that it is the duty of every honest apothecary or druggist to expose all such fraudulent acts as may come to his knowledge. But in reference to those drugs which cannot be obtained in a state of purity, he should, as occasion offers, keep physicians informed as to their quality, that they may be governed accordingly.

"8th. As there are many powerful substances that rank as poisons, which are constantly kept by apothecaries, and prescribed by physicians, and which are only safe in their hands, as arsenious acid, vegetable alkaloids, ergot, cantharides, etc.—we hold that the apothecary is not justified in vending these powerful agents indiscriminately to persons unqualified to administer them, and that a prescription should always be required, except in those cases when the poisons are intended for the destruction of animals or vermin—and in these instances only with the guarantee of a responsible person. And we hold that when there is good reason to believe that the purchaser is habitually using opiates or stimulants to excess, every conscientious apothecary should discourage such practice.

"9th. No apprentice to the business of apothecary should be taken for a less term than four years, unless he has already served a portion of that time in an establishment of good character. Ap-

prentices should invariably be entered as matriculants in the school of pharmacy and commence attendance on its lectures at least two years before the expiration of their term of apprenticeship; and as the progress of our profession in the scale of scientific attainment must depend mainly upon those who are yet to enter it—it is recommended that those applicants who have had the advantage of a good preliminary education, including the Latin language, should be preferred.

DANIEL B. SMITH, *President.*
CHARLES ELLIS, *1st Vice-President.*
SAMUEL F. TROTH, *2nd Vice-President.*

Attest: DILLWYN PARRISH, *Secretary.*"

If the Quaker apothecaries had done nothing else of moment this code would remain as a monument to the lofty principles which actuated these men who were not simply theorists, but who carried into their daily work the idealism which they held up as a pattern to their professional brethren.

In 1900 this code of ethics was somewhat modified and it now has the following form:

"THE PHILADELPHIA COLLEGE OF PHARMACY REVISED CODE OF ETHICS.
(Adopted December 31, 1900.)

"The Pharmaceutical profession being one which demands knowledge, skill and integrity on the part of those engaged in it, and being associated with the medical profession in the responsible duties of preserving the public health and dispensing the useful though often dangerous agents adapted to the cure of disease, its members should be united on the ethical principles to be observed in their relations to each other, to the medical profession and to the public.

"*The Philadelphia College of Pharmacy* being an incorporated institution, embracing among its members a large number of eminent pharmacists, manufacturers, chemists and scientists, has erected and consistently maintained a high standard of scientific attainment, which there is a growing disposition on the part of candidates for the profession to reach; and being desirous that, in relation to professional conduct and probity, there shall be a corresponding disposition to advance, its members have subscribed to the following

fundamental principles for the government of their professional conduct.

"1st. We accept the *United States Pharmacopœia* as our standard and guide for all official preparations.

"In compounding a prescription written in a foreign country the *Pharmacopœia* recognized as authority in that country is to be followed. For unofficial preparations we advocate the adoption of uniform formulas in accordance with the *National Formulary* or other standard works, published by national or international agreement.

"2d. The practice of Pharmacy can become uniform only by an open and candid intercourse between apothecaries, which will lead them to discountenance the use of secret formulas in dispensing, and promote the general use and knowledge of improved methods. This College considers that any discovery which is useful in alleviating human suffering or in restoring the diseased to health, should be made public for the good of humanity and the general advancement of the healing art. We particularly deprecate the use of secret formulas between physician and pharmacist.

"While, at present, the College does not feel authorized in requiring its members to abandon the sale of proprietary medicines, it earnestly recommends the propriety of discouraging their employment.

"3d. The apothecary should be remunerated by the public for knowledge and skill, and the charges should be regulated by the time consumed in preparation, as well as by the cost of the article sold. Although location and other circumstances necessarily affect the rate of charges at different establishments, no apothecary should intentionally undersell his neighbors with a view to their injury.

"4th. No apothecary should be engaged in furthering the interests of any particular physician to the prejudice of other reputable members of the medical profession. We emphatically condemn the allowance of any percentage on prescriptions to physicians as unjust to the public and detrimental to both professions.

"5th. As the diagnosis and treatment of disease belong to the province of medicine, and as a pharmaceutical education does not qualify the pharmacist for the discharge of these responsible duties, we should, where it is practicable, refer applicants for medical aid

to a regular physician. And we likewise hold that medical practitioners should recognize the value of pharmaceutical education and relegate the compounding of prescriptions and the dispensing of all medicines to pharmacists.

"6th. As medical practitioners occasionally commit errors in their prescriptions, which may or may not involve ill consequences to the patient if dispensed, and be injurious to the character of the prescriber, it is held to be the duty of the apothecary in all such cases to protect the physician and to have the corrections made, if possible, without the knowledge of the patient, so that the physician may be screened from censure. When the errors are of such a character as not to be apparent, without the knowledge of circumstances beyond the reach of the apothecary, we hold him to be blameless in case of ill consequences. As the original prescription is his guarantee, we recommend that it should always be retained by the apothecary.

"Apothecaries, likewise, are liable to commit errors in compounding prescriptions, and we hold that in all such cases it is the duty of the physician to protect the interests of the dispenser and stand between him and the patient as far as possible.

"7th. The apothecary should be able to distinguish between good and bad drugs, and as the substitution of a weak or inert drug for an active remedy may be productive of serious consequences, duty demands that he should exercise his expert knowledge and good judgment in the selection and preparation of all remedies. We hold that substitution or the sale of impure drugs or medicines, when pure articles can be obtained, is highly culpable, and that it is the duty of every apothecary or druggist to expose all such fraudulent acts as may come to his knowledge.

"8th. As there are many powerful substances that rank as poisons, which are constantly kept by apothecaries and prescribed by physicians, and which are only safe in their hands, we hold that the apothecary is not justified in vending these powerful agents indiscriminately to persons unqualified to administer them, and that a prescription should always be required when intended for medicinal use. When the poisons are intended for technical purposes, or for the destruction of animals or vermin, the sales should only be made to responsible persons and strictly in accordance with the State law governing the sale of such poisons.

"9th. While we recognize the value of spirituous liquors as therapeutic agents and the necessity for pharmacists dispensing these legitimately in accordance with the physicians' prescriptions, we condemn as degrading and unprofessional any attempt to make such sales a prominent feature of the business.

"We discountenance any attempt to foster or increase the use of opiates or injurious drugs possessing the power of enslaving the consumer to habitual use.

"We hold that where there is good reason to believe that the purchaser is habitually using stimulants, opiates or other injurious drugs, we should discourage such practice by every means possible, and we urge upon pharmacists the duty of exercising at all times a conscientious care in dispensing drugs liable to such dangerous abuse.

"10th. As Pharmacy is a progressive profession, its followers should, by continuous study and application, keep abreast of the advances made in medicine and the sciences. It becomes our duty to encourage the elevation of our chosen profession by stimulating research, investigation and study.

"Special care should be exercised in the selection of our assistants. No apprentice to the business of apothecary should be taken for a less term than four years, unless he has already served a portion of that time in an establishment of good character. Assistants should invariably be entered as students in a College of Pharmacy and encouraged to secure a thorough education. As the progress of our profession, in the scale of scientific attainment, must depend mainly upon those who are yet to enter it, it is recommended that those applicants who have had the advantage of a good preliminary education including the Latin language, should be preferred."

This also needs revising after twenty years of changing practice, although no improvement can be made in the underlying principles, which are fundamentally sound and worthy of perpetuation.

In 1852 our own American Pharmaceutical Association contributed its share toward the guiding principles of pharmacy and the code of ethics which was drafted during the first year of our organization was at first framed in the following language:

"CODE OF ETHICS OF THE AMERICAN PHARMACEUTICAL ASSOCIATION.

"The American Pharmaceutical Association, composed of Pharmaceutists and Druggists throughout the United States, feeling a

strong interest in the success and advancement of their profession in its practical and scientific relations, and also impressed with the belief that no amount of knowledge and skill will protect themselves and the public from the ill effects of an undue competition, and the temptations to gain at the expense of quality, unless they are upheld by high moral obligations in the path of duty, have subscribed to the following Code of Ethics for the government of their professional conduct.

"Art. 1. As the practice of pharmacy can only become uniform by an open and candid intercourse being kept up between apothecaries and druggists among themselves and each other, by the adoption of the National Pharmacopœia as guide in the preparation of official medicines, by the discontinuance of secret formulæ and the practices arising from a quackish spirit, and by an encouragement of that *esprit de corps* which will prevent a resort to those disreputable practices arising out of an injurious and wicked competition; Therefore, the members of this Association agree to uphold the use of the Pharmacopœia in their practice; to cultivate brotherly feeling among the members, and to discountenance quackery and dishonorable competition in their business.

"Art 2. As labor should have its just reward, and as the skill, knowledge and responsibility required in the practice of pharmacy are great, the remuneration of the pharmaceutist's services should be proportioned to these, rather than to the market value of the preparations vended. The rate of charges will necessarily vary with geographical position, municipal location, and other circumstances of a permanent character, but a resort to intentional and unnecessary reduction in the rate of charges among apothecaries, with a view to gaining at the expense of their brethren, is strongly discountenanced by this Association as productive of evil results.

"Art. 3. The first duty of the apothecary, after duly preparing himself for his profession, being to procure good drugs and preparations (for without these his skill and knowledge are of small avail), he frequently has to rely on the good faith of the druggist for their selection. Those druggists whose knowledge, skill and integrity enable them to conduct their business faithfully, should be encouraged, rather than those who base their claims of patronage on the cheapness of their articles solely. When accidentally or otherwise, a deteriorated, or adulterated drug or medicine is sent to the

apothecary, he should invariably return it to the druggist, with a statement of its defects. What is too frequently considered as a mere error of trade on the part of the druggist, becomes a highly culpable act when countenanced by the apothecary; hence, when repetitions of such frauds occur, they should be exposed for the benefit of the profession. A careful but firm pursuit of this course would render well disposed druggists more careful and deter the fraudulently inclined from a resort to their disreputable practices.

"Art. 4. As the practice of pharmacy is quite distinct from the practice of medicine, and has been found to flourish in proportion as its practitioners have confined their attention to its requirements; and as the conduction of the business of both professions by the same individual involves pecuniary temptations which are often not compatible with a conscientious discharge of duty; we consider that the members of this Association should discountenance all such professional amalgamation; and in conducting business at the counter, should avoid prescribing for diseases when practicable, referring applicants for medical advice to the physician. We hold it as unprofessional and highly reprehensible for apothecaries to allow any percentage or commission to physicians on their prescriptions, as unjust to the public, and hurtful to the independence and self respect of both the parties concerned. We also consider that the practice of some physicians, (in places where good apothecaries are numerous), of obtaining medicines at low prices from the latter, and selling them to their patients, is not only unjust and unprofessional, but deserving the censure of all high-minded medical men.

"Art. 5. The important influence exerted on the practice of pharmacy by the large proportion of physicians who have resigned its duties and emoluments to the apothecary, are reasons why he should seek their favorable opinion and cultivate their friendship, by earnest endeavors to furnish their patients with pure and well-prepared medicines. As physicians are liable to commit errors in writing their prescriptions, involving serious consequences to health and reputation if permitted to leave the shop, the apothecary should always, when he deems an error has been made, consult the physician before proceeding; yet in the delay which must necessarily occur, it is his duty, when possible, to accomplish the interview without compromising the reputation of the physician. On the other hand, when apothecaries commit errors involving ill conse-

quences, the physician, knowing the constant liability to error, should feel bound to screen them from undue censure, unless the result of a culpable negligence.

"Art. 6. As we owe a debt of gratitude to our prodecessors for the researches and observations which have so far advanced our scientific art, we hold that every apothecary and druggist is bound to contribute his mite towards the same fund, by noting the new ideas and phenomena which may occur in the course of his business, and publishing them, when of sufficient consequence, for the benefit of the profession."

In this code, which so evidently needs revising so as to make it accord more fully with present conditions and practices, we see that the term "apothecary" is used throughout to mean a pharmacist dispensing and selling at retail, while the term "druggist" refers invariably to what we now term the wholesaler or wholesale druggist.

Slight changes in phraseology were made in this code in the first year and the amended code as published in Vol. II (153), Proc. A. Ph. A., is still in force and has not been published within recent years, except in connection with the address of Dr. Frederick Hoffmann, delivered at the semi-centennial of the American Pharmaceutical Association in Philadelphia in 1902, and published in the Proceedings for that year, and also in the Journal of the A. Ph. A., 1915, at which time a committee was appointed to revise it, which has never since reported.

Shortly after this time a very comprehensive and excellent contribution to the subject of pharmaceutical ethics was presented to the British Pharmaceutical Conference by Joseph Ince in 1866. It is well worth publishing in connection with the other data on this same subject and is particularly interesting because of the originality of some of the views and the interesting comments upon prevalent customs.

It is as follows:

"THE ETHICS OF THE SHOP.

"Pharmacy is a trade. When a man buys goods at one price to sell them at another, gaining the advantage of the difference in tariff, being further influenced by the known law of supply and demand, he is engaged in trade. When he buys in undivided bulk,

to sell again in undivided bulk, he is a merchant, but still engaged in trade. When he purchases in undivided bulk to vend in large though in divided bulk, he is a wholesale tradesman. When he buys articles in a divided bulk, to sell again in small divided bulk, he is a retail tradesman; nor does it make the slightest difference whether he sells hats or Turkey rhubarb, nor whether the seller of the rhubarb be Sir Humphry Davy.

"The artist, on the other hand, is a professional man. One painter buys so many feet of canvas, together with so much paint; he places, possibly, upon that canvas something which may not increase its value. A second buys the same amount of canvas, inch by inch, on which he puts the same amount of color, ounce for ounce, and the result may be 'The Immaculate Conception.'

"He places on the canvas that which he cannot buy—God gave it him, and without any phrase of poetry he exercises the gift divine. Neither is the true artist influenced by the necessities of competition, nor by the trade fluctuation arising from supply and demand.

"A hundred artists more or less would not alter his position; a hundred paintings on the same subject would not detract from the merit of his own, its value is intrinsic, and not relative. But the pharmaceutist buys his stock, whether of drugs, chemicals, or sundries, in order to sell again—he is a tradesman.

"But other influences are at work to modify the general fact—the awakening claims of universal education, the long unfaltering teaching of our own Society, the actual pressure from without. Then there is the influence of locality; the West End customer will have more than shop dexterity, and in my own neighborhood the mere tradesman would find himself gazetted.

"There is the influence of individual character. The master, fortunately for himself and those around him, has higher than trade instincts, from which circumstance his trade assumes more or less a strictly professional character; but it no more ceases to be a trade than the orchid which counterfeits so strangely shapes of natural beauty ceases to be a plant.

"Never forgetting the essentially trade nature which belongs to pharmacy, we at once come to the first ethical rule of the pharmaceutist, namely, the necessity for the absolutely genuine character of his drugs. No drug or remedy should be admitted

into his shop other than that which, in case of dangerous illness, he would not hesitate to supply to the inmates of his own family circle. He cannot be expected to keep the whole range of Materia Medica, nor is he to be blamed for applying for eclectic remedies elsewhere. This is an affair of means and circumstances; but in no case should any trade casuistry induce him to lower the standard of excellence of whatever he may possess.

"The pharmaceutist who bears this rigidly in mind will be in no danger of degrading himself by the adoption of low and ruinous prices. Whoever has committed this transparent trade mistake must not afterwards blame the public for exacting the continuance of a state of things to which he has himself voluntarily stooped. On this topic I have great pleasure in giving you the opinion of your excellent treasurer, Mr. Brady:—'The principle which ought to guide the pharmaceutist in the regulation of his charges is that remuneration should increase in proportion as the class of article makes greater demand on the knowledge obtained by his professional education. If he sells articles dealt in by other classes of tradesmen, he must submit to the same rate of profit. In drugs proper, which require an educated judgment, power of testing and the like, he is entitled to a much higher rate; whilst in all matters of dispensing, his charges should be professional in their character, and not calculated on the cost of employed materials at all. We cannot materially increase the quantity of medicines sold by reducing the price; hence any of us endeavoring by low charges to increase his business must recollect that he does it to the direct injury of the body, in reducing by so much the amount of money that might accrue from its legitimate practice. In large towns the responsibility of prices charged rests with one or two leading men, and if they are true to their professional instincts, the calling can scarcely fail to prosper.'

"I agree with the above, and I may add that the pharmaceutist saves himself an immensity of trouble, and will most probably prolong his days if he will once have the courage to adopt one uniform fixed price, else he is subjected to continual petty annoyance. Having determined to be the master of his own business, he will be content to abide by his own regulations, and not, on the one hand, place himself at the mercy of the competing pharmaceutist who trims his sail to every wind that blows, or, on the other,

to the caprice of the customer, who not always truthfully asserts that he has obtained articles of definite commercial value at a starvation price.

"Not only his regard to self-respect, but to his trade interest, will be his guide to a third ethical observance, *viz.,* to supply the public with the precise articles for which they ask. This point strikes me not so much as a question in ethics as in a purely business light; but I have been requested to bring it forward, and I am bound to do so.

"The rule of every well regulated establishment is to supply faithfully and implicitly whatever in the whole range of pharmacy a customer may require—to obtain it if not in stock, whether English or foreign, and to spare no pains that it shall be the identical thing desired.

"To do otherwise seems to me not to warrant so fine a phrase as a trade error, but a pure shop mistake. Does the customer want liquor bismuthi, Schacht, he is supplied from Clifton; does he send for Brown's chlorodyne, he receives that made by Mr. Davenport; if quinine be ordered, salicine must not be substituted; and so with the list of similar preparations, whether demanded as a retail order, or as forming an ingredient in a physician's recipe. This course of action is due not to any particular keen sense of honor, but to trade expediency, precisely as a wise fisherman spreads a well-made net in order that the fish should not slip through. Any house in town or country adopting such a principle must and does gain a reputation which infinitely counterbalances the small extra remuneration to be made out of fictitious articles. Confidence brings trade, and trade puts money in the till—a more practical result than might have been anticipated from the study of pharmaceutical ethics.

"This subject may have been proposed in consequence of some of its details not having been clearly grasped. On the one hand, there is a great waste of misapplied ingenuity in the constant attempt to produce colorable imitations of preparations, secret or otherwise, which have gained reputation for some particular chemist. Against this there is no human law; but the moral law, which is the law of God, says such practices are fraudulent, and beneath the dignity of every upright man, and they betray a paucity of inventive power, and it is, moreover, certain that the same skill

might find more creditable as well as more remunerative employment.

"Still, some pharmaceutists are in bondage to a groundless fear; they hesitate, under a strained sense of honor, to enter upon what they think preoccupied, and therefore forbidden ground. 'Why,' writes Mr. Giles, 'should there be any speciality in pharmaceutical production? The same laws will protect an invention in pharmacy as in mechanics, and when the law professes to deal with the matter, it is a question whether any other protection is needed. You may say ethics shall do what the law does not, and so it should in cases too refined for the law to deal with; but here the law does operate.'

"From the foregoing it is clear that while no one is justified in the fraudulent imitation of a patent right, either in or out of the sale of pharmacy, yet no pharmaceutist can claim the exclusive manufacture of any special article in perpetuity, simply because a particular mode of working originally suggested itself in his mind. There is no law in trade or ethics to prevent a man making liquor opii to the best of his ability, any more than in the case of morphia and meconic acid. The most scrupulous and conscientious chemist may get quinine and cinchonine from bark. What casuistry shall assign an arbitrary limit forbidding him to make a liquor? The whole world may make magnesia, light and heavy, calcined or carbonate, although Battley and Howard and Henry have been beforehand in the field. Let not the pharmaceutist shrink from the lawful use of the experience and labors of the past; which is no reason why he should shrink into a mere copyist, and should not, like Columbus, sail out of the beaten track in search of land not hitherto discovered.

"There is a major ethical consideration that can only be treated in a minor key—perfect civility to, and careful attention to the smallest wants of the poorest customer—a civility that should be expressed by words and manner. The ethics of civility to rich customers need scarcely be discussed; in that case, for ethics, read advantage.

"Our American brethren have taken the lead in drawing up a regular Code of Ethics. You will find the document in the *Pharmaceutical Journal*, Vol. XII, p. 369.

"They have also, I think, been most successful in giving directions about the last topic I have to mention in connection with shop ethics—the mutual relation between the master and the assistant.

"For general rules I refer you to a paper republished in our *Journal,* called the 'Pharmaceutist as a Merchant' (Vol. VI, p. 655, second series). The idea is admirable, and the literary execution quite equal to the design.

"Mr. Frederick Stearns, the author, seems to have steered most successfully between the 'Scylla of the high and dry, and the Charybdis of the goodly-good.

"I refer you also to some excellent rules published at the end of 'Parrish's Practical Pharmacy;' it contains one difficult proposition, p. 676.

" 'Second General Regulation of the Store. During business hours all hands must be on their feet.'

"Rule XIII is beyond our present standard. 'Every apprentice will be expected to become a graduate of the College of Pharmacy, and will be furnished with tickets of the College, and every opportunity for availing himself of the honor of the degree of that Institution.' I do not feel called upon to dilate upon this question. There is such a wide difference in individual character, that special rules seem to be impossible. After all, we shall scarcely get further than the inspired direction. 'He that ruleth with diligence.' One point I am compelled to notice, that ethics concern the assistant quite as much as they do the master. I have no intention of adding to the already hard position of the former by harsh remarks, but I say deliberately that neither our current literature, nor the general tone of sentiment expressed in private, bears sufficient trace of the recognition that a code of ethics extends beyond the master. Let the assistant feel that he has a part to play, just as difficult and just as important as his employer; that on his side he must exercise consideration, and adopt the high tone of feeling which characterizes the English gentleman, and he will do more to render pharmacy endurable, and to promote its social welfare, than whole reams of essays written on the subject. It is painful to recollect that those identical assistants who complain the most bitterly about long hours, close confinement and other ills incident to pharmacy, are sometimes, when once in business on

their own account, the very men to perpetuate and extend the evil and, practically, to rivet another link to that chain with which we are darkly bound. Solely for this reason, I have no faith in the efforts that have been made occasionally with regard to early closing. The ethics have been invariably on one side. Once the king of animals was asked his opinion on a work of art. The painting represented a man smiling and self-confident, who, with the most perfect equanimity, was slaying the noble beast. 'Wait till I paint,' said the lion.

"As matters stand, masters are to shut up, and assistants to improve their minds. I have never seen my way out of this question (nor has any one else); yet I believe that in an establishment where there are two or more assistants, if they would calmly set to work to see how far earlier hours could be adopted without injuring existing business, if, in so doing, they on their part would carefully weigh the master's interest, and be as ethical towards him as they wish him to be towards them; and if, instead of calling him hard names and making excited speeches at a London tavern, they would bear in mind that he is quite as much interested as they, I guarantee that he would be found a willing listener, and there would then be the first and only fair chance of which I know, of both being set at liberty at more rational hours than they are at present.

"Before leaving the shop altogether, may I press upon your consideration the desirability of calling it 'a pharmacy.' The word is English, not fanciful; it is used in the same sense throughout France, and Belgium, is highly expressive, and is on all grounds to be recommended."

(To be Continued.)

SOME APPLICATIONS OF THE MICROSCOPE IN RESEARCH.*†

By Henry Leffmann, A. M., M. D.

Lecturer on Research, Philadelphia College of Pharmacy and Science. Member of the Institute.

The microscope in its present form is one of the most perfect and useful instruments available in research. Its construction may be said to date from the closing years of the seventeenth century, although the general idea of magnification by curved glasses and mirrors was applied long before. While magnification is the basis of the instrument, its usefulness would be much restricted if that property alone was available. Newton's discovery of the composite nature of light gave a strong impetus to both practical study and theoretic suggestion in connection with all forms of optical instruments. Newton believed that refraction and dispersion were commensurate in all cases, and declared that it was impossible to construct a lens which would produce a colorless image. It was discovered, however, that substances of the same refractive often have different dispersive powers and Dolland was able to construct a lens capable of forming a colorless image of an object illuminated by white light. These "achromatic" lenses are now part of all microscopic outfits.

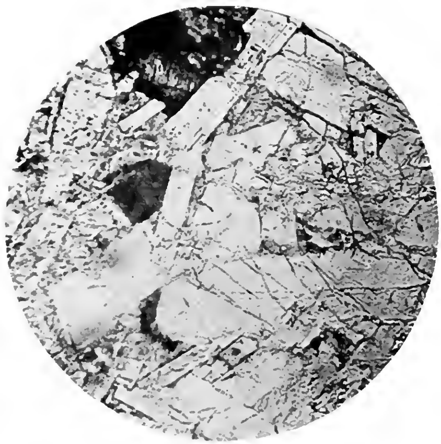
The essential function of the microscope is to make small objects visible to the human eye, but *definition*, that is, the clear indication of form and structure, is also essential, and the later work of improving the microscope is directed especially to securing this. It has been accomplished partly by improvements in lenses, but largely by modifications in the nature of the light and the method of applying it. The most simple modification is that of changing the direction of the beam that illuminates the object to be examined. The natural way, which was at first used, is to allow the beam to pass directly through the object, that is, perpendicular to it, or to fall upon the surface at a similar angle. By passing the ray obliquely, or concentrating it as a cone centering in the object, shadow effects are produced which are often very satisfactory.

*Abstract of a paper presented at a meeting of the Section of Physics and Chemistry held Thursday, October 27, 1921.

†Reprinted from *The Journ. of the Franklin Instit.*, January, 1922.

The application of photography to microscopy has been of great service, as it not only permits of permanent record of the field, but as the photographic plate has a different sensitiveness to light than has the human eye, differences of structure will be brought out by this means that the unaided eye would overlook. The ordinary photographic emulsions are not sensitive to green, yellow or red light. By special methods this sensitiveness may be extended so that a strong light of any color will affect the plate. Using plates of wide range of sensitiveness, color screens can be inserted by which excellent results are often secured. Another modification of light which has been of immense advantage in all fields of optics is polarization. The term is applied to modifications of light by which

SECTION OF DOLERITE × 30. WHITE LIGHT.



SECTION OF DOLERITE × 30. RED SCREEN.

it becomes much more sensitive to structure so that differences wholly inappreciable to the unassisted eye are brought out clearly. These differences are often indicated by brilliant colors, so that the several parts of the object are not only clearly indicated but the color contrasts are striking and often beautiful.

Another direction in which the service of the microscope has been advanced is in the preparation of the object. Many methods for this purpose are employed. One of the most used is sectioning, that is, cutting the specimen into thin layers. In the case of animal and vegetable structures this is comparatively easy, and has been employed from an early period, but mineral structures are more dif-

ficult to handle. Sorby, a British scientist, developed about the middle of the last century the method of grinding minerals so thin as to be transparent, and laid the foundation of the science of petrology which has become of great importance in mineralogy and geology. In the case of metals no amount of cutting will render them transparent to ordinary light, but many important data have been obtained by examining flat surfaces before and after etching. A special department of industrial microscopy—metallography—has grown up by aid of the methods of which the minute structure of commercial metals and alloys is capable of elucidation.

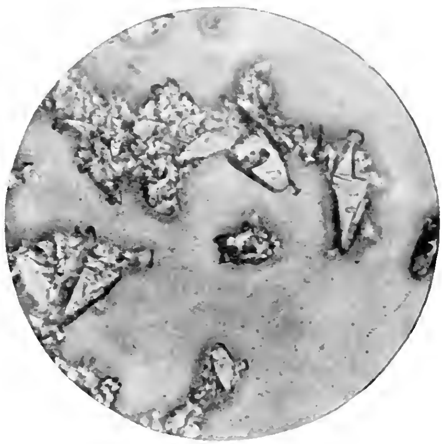
The microscope has found extensive and useful application in medico-legal work. Its revelations are often surprising and sometimes border on the humorous, because of the results being so different from what was assumed. During the late war cases of admixture of powdered glass with food were occasionally alleged. No case in which such a charge was substantiated seems to have been established, but several investigators have reported the actual facts. In one case crystals of ammonium magnesium phosphate were found; in another, in which it was suspected that grape-jelly had been so adulterated, the analyst (Doctor LaWall) found that the substance was merely cream of tartar (acid potassium tartrate) in comparatively large crystals. The client, however, was firm in his opinion, and it was not until the analyst dissolved some of the material in hot water that he was convinced it was not glass.

Messrs. Zoller and Williams, of the United States Bureau of Agriculture, recently reported a case of "sandy" ice cream, which on microscopic examination was found to owe its grittiness to numerous crystals of milk sugar. Commercial white arsenic (arsenous acid), the common poison, is found in two forms, a glassy or porcelain-like mass and a gritty powder. The latter generally shows distinct crystals, visible under moderately high powers, the particular form being the regular octahedron, but much broken up. This form of arsenic will remain for many hours in the stomach without material modification so that the substance may be identified directly. In one case of criminal poisoning, the defence set up the theory that the dead person had been taking homœopathic triturations of arsenic, but the expert for the state pointed out that the arsenic found in the stomach was distinctly crystalline, which proved that it had not been triturated. The prisoner was convicted and executed, and subsequently

his attorney admitted the correctness of the inference, and the remainder of the arsenic, which had been bought for the poisoning, was given to the expert.

By making thin sections of fossils and coal much information may be obtained as to the origin of these materials. Coal shows vivid evidence of its vegetable origin, not only by the impressions of leaves and stems, that are visible to the naked eye, but on magnification, the minute details of the cell structure and spores. Considerable advance has been made lately in the study of coal, by treatment with hydrofluoric acid, by which the mineral matter is in great part removed, and thus the remains of the vegetable structures made more evident.

SECTION OF COAL × 120. SHOWING VEGETABLE CELLS.

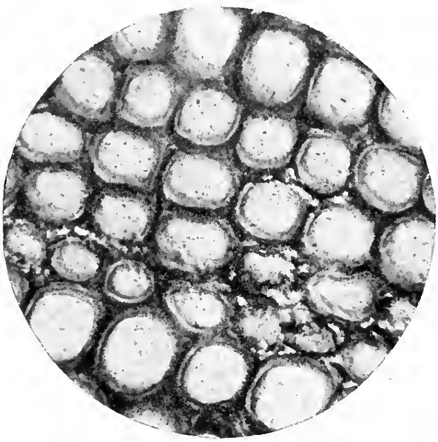


CRYSTAL OF MILK SUGAR × 100.

The fossil tree-trunks in the petrified forests of Arizona have retained the vegetable structure through the solidification, even to very minute detail, and by the microscope it can be shown that they are cone-bearers, related to our pines and spruces. They show clearly the peculiar dotted cells, technically known as the "bordered pits" which are characteristic of that group of plants.

In the field of pathology and bacteriology the microscope has been of immense use. Its applicability has been materially increased by the use of cultures and staining systems. The invention of the solid culture medium, by Doctor Koch, has been one of the most important accessories in this work. Micro-organisms can be cultivated

in many liquids and on many surfaces, but the different species remain in intimate mixture and study of individual forms is impossible. By incorporating into the culture fluid a substance which is liquid when moderately warm, but solid at ordinary temperatures, the organisms can be cultivated separately. Gelatin and agar are usually employed, the latter being especially applicable for cultures made at blood heat, as its jelly does not melt at that temperature. The procedure, in outline, is to prepare a sterile culture medium containing the jelly-forming substance, inoculate under proper precautions, spread it in a shallow dish, and cover it with a protecting



TRANSVERSE SECTION OF PETRIFIED WOOD. PETRIFIED FOREST OF ARIZONA × 120.

SECTION OF PETRIFIED WOOD × 120. SHOWING "BORDERED PITS" WHICH INDICATE CONE-BEARING TREE.

lid. When cold the jelly sets, and the individual organisms multiply in their places, soon forming colonies so numerous that they are large enough to be seen by the naked eye. In growing, some organisms produce marked changes in the condition of the gelatin or agar. Some digest it partly, causing spots of liquid, others produce colors. One well-known and common organism produces a blood-red stain. From the colonies thus indicated, portions can be taken and separately cultivated, just as one can gather seeds from the mature plants of a garden.

One of the latest applications of the microscope is its use in determining the index of refraction. This datum is the expression of the amount to which the ray of light is bent on passing from air

into the mass of the substance under examination. The figure for the index is obtained by dividing the sine of the angle of incidence by that of the angle of refraction. In dealing with solids and liquids as compared with air the quotient is, of course, always greater than unity. Differentiation of both solid and liquid substances can be made rapidly and accurately by determinations of this index. In microscopic work, the method is largely applied in examining crystals.

In examining substances more or less transparent immersed in a liquid, the individual particles are seen to be surrounded by a series of bands either in monotone or in colors. The relative extent of these bands depends on the difference between the refractive index of the substance and that of the liquid bathing it. If the objects examined are entirely homogeneous, without color, have the same refractive and dispersive powers, and also the same absorptive powers for light as the liquid, they will become invisible. All these conditions as coincident are not found in practice, so there is always some visibility. In practice the vanishing of the dark bands is the phenomenon that is used to aid in the examination. If, for instance, a crystal is examined successively in liquids of which the index of refraction is known, it is possible to determine that of the solid, by noting the liquid in which the dark bands are just eliminated.

By these means crystals of very small size can be identified and many interesting and valuable results have already been obtained. Dr. Edgar T. Wherry, of the United States Bureau of Chemistry, has for several years been devoting a great deal of attention to this phase of research and has made many determinations. One of the most interesting and valuable was in the detecting of the cause of mortality among bees in some parts of Pennsylvania. The honey on being examined was found to contain crystals of unusual form, and as the amount was very small resort was had to the determination of the index of refraction, by which the substance was identified as melezitose, a sugar that is of no nutritive value to the bee. This had been obtained probably by the bees collecting exudations on pine trees, during a period in which flowers were scarce. Doctor Wherry made also examinations of some high explosives which were of different colors as produced in different factories and found that the difference was due to enclosures in the crystals.

Efforts have been made of late to apply the refractive index to the differentiation of the common alkaloids. Some of these are powerful poisons, and as they are used in small amount the processes of analysis have to be very delicate. Many of the tests depend upon color produced by reagents, but in these the alkaloid is destroyed. The crystalline forms of the alkaloid itself or of its salts are sometimes fairly characteristic, but as a rule such method is only applicable to the pure substance. In toxicologic analysis the material is often difficult to obtain perfectly pure, and this complicates the work. Naturally the determination of the refractive index seems to be a possible method, but one difficulty has arisen, namely, to secure liquids which do not have a solvent action on the crystal. It is obvious that if the substance dissolves in the liquid bathing it, no accurate test can be made. Human ingenuity is, however, almost limitless, and it is reasonable to expect that some method will be found by which this useful datum will be made available for the toxicologist and pharmacologist in identifying these important substances.

ACETYL-SALICYLIC ACID IN SODIUM CITRATE SOLUTION.*†

By Paul Nicholas Leech, Ph. D., Chicago.

Acetylsalicylic acid ("aspirin") is dispensed in dry condition because it is easily decomposed in the presence of moisture; also it is insoluble in water. However, articles have appeared recently in both medical and pharmaceutic literature claiming that acetylsalicylic acid may be dispensed *in solution* by aid of sodium citrate; also that the acetylsalicylic acid would not be decomposed. For instance, the following, which was probably abstracted from some American pharmaceutic publication, appeared in the *Prescriber*:[1]

"Acetylsalicylic acid (aspirin) is practically insoluble in water, and though soluble in alcohol such a solution is not generally suitable for administration. It is therefore usually given in tablets or

*From the Chemical Laboratory of the American Medical Association.
†Reprinted from *Journ. Amer. Med. Assoc.*, January, 1922.
[1] Solvent for Acetyl-Salicylic Acid, *The Prescriber*, June, 1921, p. 247.

cachets. Solution may be effected by addition of sodium bicarbonate, but as the resulting solution is merely a mixture of sodium acetate and sodium salicylate, this method is not admissible. It is said that sodium citrate will dissolve acetylsalicylc acid without dissociation; for each grain of aspirin four grains of sodium citrate should be added. Such a solution, flavored with syrup of lemon, is suitable for administration to children.

The usual test for decomposition of acetlysalicylic acid is the detection of the freed salicylic acid by means of ferric chlorid solution. It occurred to me, therefore, that possibly such a test was used as a basis of the contention of the non-decomposition of acetylsalicylic acid in sodium citrate solution. If so, the seemingly negative reaction obtained may be misinterpreted, because citric acid, and citrates, interfere with the sensitiveness of the test, and hence it would not be reliable in the case at hand. To test this hypothesis, a solution was made up and the rate of hydrolysis determined by titrating with normal alkali during stated intervals. The solution was prepared by dissolving about 18 gm. of pure acetylsalicylic acid and 72 gm. of sodium citrate in 240 cc. of water; after standing three hours it was filtered, and 20 cc. used for the individual determinations. One teaspoonful of such a solution would represent about 5 grains of acetylsalicylic acid. The results of the titration will be found in the accompanying table. The solution was maintained at room temperature.

RESULTS OF TITRATION.

Interval of Time.	Cc. of N/1 NaOH Consumed by 20 cc. of Solution.
3 hours	8.0
1 day	9.4
2 days	10.7
3 days	11.35
$3\frac{5}{6}$ days	11.80
6 days	12.70
9 days	13.80
14 days	14.85
17 days	15.20
Complete hydrolysis	15.70

Acetylsalicylic acid is hydrolyzed fairly rapidly in sodium citrate solution, over 50 per cent. decomposed in four days, and 75 per cent. in nine days. Thus, a patient taking such a mixture which

was nine or more days old would be getting essentially the same ingredients as if sodium acetate and sodium salicylate had been used in place of the acetylsalicylic acid.

Obviously, the assertion that acetylsalicylic acid is not broken down to form salicylic acid and acetic acid (or their salts) is not based on scientific work.

The hydrogen ion concentration of the citrate solution alone was $p_H = 9.0$; after addition of acetylsalicylic acid, it was $p_H = 5.4$; after seventeen days it was $p_H = 4.6$ Thus it may be seen that the solution is appreciably acid, sufficient to decompose hexamethylenamin, with which it has been recommended to be dispensed.

Very recently one part of potassium citrate has been suggested in place of four parts of sodium citrate. Such a solution would hydrolyze, if anything, faster than one made with a higher concentration of the sodium salt.

CONCLUSION.

It has been claimed that acetylsalicylic acid may be dispensed in a solution of sodium citrate without decomposition of the acetylsalicylic acid. The experiments here reported show that this is incorrect, that after four days the acetylsalicylic acid is broken down to the extent of 50 per cent.; after nine days, to 75 per cent., and that in seventeen days it is almost completely hydrolyzed.

THE SIGNIFICANCE OF CALCIUM FOR HIGHER GREEN PLANTS.

By RODNEY H. TRUE. *Science*, 55, 1410, 1-6, 1922.*

Interest in the subject of Calcium as a necessary plant food began to develop as far back as 1856 when Salm-Horstmar proved that this element is necessary for seed plants. Additional light was thrown on the calcium problem by Sydney Ringer in 1883, who, while working on the characteristic effects produced by various salts in prolonging the life of organisms in water culture, observed that when fish were placed in distilled water calcium and other salts were extracted from them and epithelial and mucous cells seemed to become detached from the gills. Ringer later experimented with Tubi-

*Abstracted by Heber W. Youngken.

fex, a fresh water worm, and found that after this animal was kept in water from which calcium was excluded, the worms disintegrated and when calcium was added to distilled water the worms lived and behaved as in river water. Herbst in 1900 confirmed the fundamental features of Ringer's work, when he showed that in certain sea-urchin larvæ grown in sea water from which Calcium was lacking the epithelial tissues dissolved into their component cells and that when these dissociated but still living elements were returned to calcium containing sea water, they adhered again to each other at their points of contact.

The author reviews the work of himself and colleagues on the physiological properties of distilled water in which the method of electrical conductivity was applied to the investigation of ion changes in solutions in which seedlings were growing. These experiments demonstrated first, that the conducting capacity of distilled water in which seedlings were grown increased, due chiefly to the leaching of ions from the cells of the seedlings, second that this leaching was checked when a small quantity of Ca salt was added to the distilled water, third, that Ca ions differed from Mg ions in being harmless in concentrations that proved fatal in the case of Mg.

Dr. True also relates how the conducting method was next applied to the problem of absorption by phanerogamic seedlings from solutions of the ordinary nutrient salts. As a result of the study of various kinds of seedlings grown in solutions of single salts it was found that in solutions of K and Na salts no concentration was observed in which the seedlings were able to carry on sustained absorption. In the end the seedlings yielded more ions to the medium than they took from it. Again, it was found that in mixtures absorption or leach depended on the presence of Ca or Mg ions. Calcium in high proportion never brought injury and Mg injury appeared less often than in single solutions. It was further noted that in mixtures containing Ca and other nutrient ions, the total quantity of ions absorbed far exceeded the quantity of Ca ions present. This showed that in such mixtures Ca ions in some way secured conditions that bring about the absorption of ions which, when offered in unmixed solutions, would be unabsorbable or would cause an active leach of other ions from the plant cells.

The author thus logically concludes that the Ca ions make other ions physiologically available to the plant.

The author next takes up the question of the chemical relation between the calcium content of higher plants and the cell wall. He cites the investigations of Fremy, Mangin, Bertrand and others who showed that cell walls were not homogeneous structures but consist of an outermost boundary layer between adjacent cells of a calcium salt of a weak organic acid known as pectic acid as well as other layers lying between it and the plasma membranes. Ca pectate is a stiff adhesive colloid that is formed when Ca ions meet pectic acid. Pectic acid appears when the neutral substance pectin is acted on by the enzyme pectase. He further cites Sampson's observations of how cellulose cell walls in the abscission tissue of Coleus leaves are changed to pectic acid with the disappearance of calcium ions from the cells and walls following injury. He calls attention to the change in firmness of fruits and vegetables following the action of saprophytic or parasitic fungi as being likely due to the removal of Ca by acids, the pectate layers becoming pectic acid or something akin.

He next reviews the work of Dr. Sophia H. Eckerson, who in 1919-20 grew seedlings of wheat, maize and white lupine in a series of balanced solutions and who applied microchemic methods to the study of seedlings grown in potassium solutions in which the author had found a leaching of ions from the seedlings into the solution. This work demonstrated (1) that ions readily enter the cells of the roots, (2) that within 24 hours Ca ions began to diffuse out of the calcium pectate middle lamella, (3) K pectate was formed instead of the Ca salt and this substance being relatively soluble in water soon dissolved, (4) at this stage, sugars, amino-acids, and salts, chiefly Mg, diffused rapidly out of the roots. The leach into K solutions is largely organic and non-electrolytic showing the solutions to have come in considerable part from the cell contents. The permeability of the cell walls had so been greatly modified as well as the osmotic properties of the plasma membranes.

Experiments on corn seedlings by the same worker showed that permeability for ingoing ions is likewise increased by the changes described. Experimental work on Mg solutions showed that Mg pectate replaced Ca pectate in solutions of Mg salts. After examining the results of a long series of experiments in various culture solutions, the author declares that no kation other than Ca has been found that can replace it in the colloidal compound forming the mid-

dle lamella without an injurious or fatal change seen in permeability relations or without the appearance sooner or later of other toxic response.

In view of the results cited, the author next philosophizes on the phenomena lying deeper than the cell walls. He regards the cell walls and plasma membranes that secrete it as standing in the closest relation. He states: "Cell walls, except in specialized locations, are seldom decisive in determining what ions pass through them. They influence up to a certain quantity the ions that pass into them, through the chemical changes which take place in the walls themselves. Beyond that, after chemical demands in the walls have been satisfied, more deeply lying equilibria are concerned. As an ion-containing structure, the cell wall maintains ion-equilibria subject to the laws of equilibria in colloids, with the living membranes with which it stands in most intimate chemical and biological contact. When ion equilibria in the wall are disturbed, this disturbance is transmitted to the equilibria of the protoplast that lays it down, modifies it and remains in closest relation to it."

As an example of emphatic control of cell walls by life inhabiting them, he cites the condition in the developing fruits of wheat and maize.

The embryos of these normally have a dozen or more cells surrounding them. In response to intrinsic or formative laws governing the organisms, these cells are completely absorbed and in the end the innermost remaining walls of the ovary are cemented to the outer unabsorbed layer of the inner integument. He claims this control to be exerted chiefly through the agency of the Ca-ion equilibria of the tissues concerned.

The substances necessary for the formation of the cementing layer appear, according to Dr. True, to be extruded from the protoplasm through the wall to the outside surfaces where they unite to form the coagulum. It is conjectured that Ca ions and pectase thrust through from the interior of the cell meet at its frontier the pectin which under enzyme action yields pectic acid that then unites with Ca ions to form the cementing calcium pectate layer between adjacent cells.

In conclusion the author points out the fact that calcium ions make physiologically available other equally indispensable nutrient ions and alludes to this as clearing up some previously unsolved questions.

ATOMIZING THE ATOM.

(Reprinted from *Science Service.*)

How one element can be changed over into another was explained recently to the Chemical Society of London by Professor Sir Ernest Rutherford, of Cavendish Laboratory, Cambridge, who has gone farther than any other man toward realizing the old dream of the alchemists.

We are as far off as ever from the making of gold out of lead, but experiments by Professor Rutherford have previously shown that it is possible to get hydrogen out of nitrogen.

Professor Rutherford declared that it is also possible to obtain hydrogen from at least five other elements, boron, fluorine, sodium, aluminum and phosphorus.

These experiments have given us an entirely new idea of the structure of the atom. As Professor Rutherford says: "Since the development of the atomic theory on an experimental basis by Dalton, the progress of chemistry has been based on the central idea of the permanency and indivisibility of the atoms of the elements. The whole experience of chemistry for nearly a century had shown clearly that it was impossible to break up the atoms of the elements by the application of ordinary chemical and physical processes. This idea has had to be modified to some extent by the rapid growth of our knowledge during the last twenty years of the inner constitution of the atoms. It is now generally accepted that the atoms of the different elements have all the same general type of structure. At the centre of the atom is a positively charged nucleus of minute dimensions which is responsible for most of the mass of the atom. This is surrounded by a distribution of electron held in equilibrium by the forces from the nucleus.

"By the action of light and electrical discharges, we can readily remove one or more of the external planetary electrons from the atom, while by the action of X-rays we may even eject one of the more strongly bound electrons of the system. In this way, we can effect in a sense a transformation of the atom but it is merely a temporary one and a new electron is soon captured from the outside and the atom is as before. The general evidence indicates that even if a number of the planetary electrons were removed by suitable

agencies the stability of the nucleus would not be disturbed and the atom would in a short time regain its original structure. In order to effect a permanent charge in the atom it appears to be necessary to disrupt the nucleus itself. When once a charged unit of the nuclear structure is removed, the nuclear charge is altered permanently and there is no evidence that this process is reversible under ordinary experimental conditions.

"The discovery of the instability of the radioactive elements was the first severe shock to the idea of the permanency of all atoms. This radiating property is, however, confined mainly to the two heaviest elements, uranium and thorium, and their long series of descendents, and is only shown by two other elements, potassium and rubidium, and then only to a minor extent. Apart from these exceptions, the great majority of the atoms appear to be highly stable structures and to remain unaltered under ordinary conditions in this earth for periods of probably thousands of millions of years.

"The property of radioactivity belongs to the nucleus and is shown generally by the emission of a swift particle or helium nucleus and occasionally a swift electron from the nucleus. The number and velocity of emission of these particles appear to be quite uninfluenced by the most powerful physical or chemical agencies and to be an inherent property resulting from the instability of these very complex nuclei.

"These results show clearly that the nuclei of heavy atoms contain both positively charged helium nuclei and negative electrons, and lead to the general view that the complex nuclei of all atoms are built up of hydrogen and helium nuclei and electrons. It is also generally supposed that a helium nucleus itself is a secondary unit composed of four hydrogen nuclei and two electrons. If this be the case, we may suppose the nuclei of all atoms to be composed ultimately of hydrogen nuclei, or protons as they have been termed, with the addition of negative electron.

"It is probable that the forces which bind together the components of the nucleus are exceedingly powerful and that consequently a large amount of energy will be required to disrupt its structure. The swift alpha particle from radium and thorium, which is by far the most concentrated source of energy known to us, seems the most likely agent to succeed in an attack on the strongly bound nucleus. The alpha particle is expelled from radium with a

velocity of about 10,000 miles per second and thus has a speed 20,000 times greater than that of a swift rifle bullet. Mass for mass, its energy of motion is 400 million times greater than that of the bullet."

In investigating the disintegration of atoms, Professor Rutherford makes use of the same phenomena that are displayed in the luminous watch dials made of a radioactive element bombarding zinc sulphide. He allows the particles projected from radium to bombard the element and then counts the number of electrons or hydrogen atoms that are knocked out by the flashes they produce when they hit a screen of zinc sulphide.

"If we had charged atoms available of ten times the energy of the alpha particles of radium, we could probably penetrate the nuclear structure of all atoms and occasionally effect their disintegration," states Professor Rutherford. "The general evidence indicates that the atoms as a whole are such stable structures and the nuclei are held together by such powerful forces that only the most concentrated source of energy like the alpha particle is likely to be effective in an attack on such well protected structures."

SCIENTIFIC AND TECHNICAL ABSTRACTS

The Resin of Kava Kava (Piper Methysticum).—The resin was dissolved in ether to free it from methysticin, the ether solution was washed with dilute alkali and then with dilute sulphuric acid and was dried with potassium carbonate. Removal of the solvent left a thick, dark brown, oily residue. When this was heated with 10 per cent. sodium hydroxide solution Kavaic acid was obtained. This product is, apparently, y-cinnamal-acetoacetic acid, $C_6H_5.CH:CH.$-$CH:CH.CO.CH_2.COOH$. Yellow needles from methyl alcohol, M.P. 164-5° (decomp.). It readily parts with CO_2 and yields a dark yellow resin which, on distillation, produces cinnamal-acetone, $C_6H_5CH:CH.CH:CH.CO.CH_3$. (W. Borsche and A. Roth, *Ber. d. d. chem. Ges.* 54, 2229, 1921.)—J. F. C.

A New Motor Fuel.—An enforced situation in Germany a few years ago, brought about by the interruption of importation of petroleum and petroleum products, reflected a condition which the world will eventually face universally, and resulted in the search and discovery of substitutes which were able to take the place of gasoline and lubricating oil in particular. This work has been described in *Auto-Technik* and *Revue des Produits Chimiques.* The Germans fell back on coal tar from which they obtained benzol and naphthalene. The former has been used as a motor fuel for some time in admixture with alcohol and gasoline. The latter, when treated with hydrogen in the presence of the catalyst nickel, gives a series of products, one of which, known as tetralin, has been used recently with great success in the operation of automobile engines. The results obtained were even better than those ordinarily secured with gasoline as the fuel, for tetralin has a high specific gravity and a much greater calorific power than gasoline. Per kilogram, this is 11,600 calories for tetralin against 11,000 for the best grade of gasoline. The tetralin is not used alone but in admixture with alcohol and benzol, in the proportion of two of the latter and one each of the former. The ordinary form of carburetor may be used, but it must be adjusted to give increased admission of air, and it is advisable to preheat the fuel with the waste heat from the engine before allowing it to enter the cylinder. It is possible to start an absolutely cold engine with this composition fuel. The mixture will not foul the spark plugs. A test was made with the fuel on a standard make of car in Germany, which was run a fixed distance with an absolutely cold engine with this composition fuel. The regular type of carburetor was used, the same one in each test. The tetralin fuel ran the car twenty miles to the gallon, while the gasoline fuel ran it twelve miles per gallon under identical conditions. This indicates an increased efficiency in favor of the new fuel to the extent of 66 2/3 per cent. The speed of the car reached 55 to 65 miles per hour.—Through *Industrial Digest.*

Insect Enemies of Typha latifolia.—An intensive study of the Insect Enemies of Typha latifolia L. P. W. Claassen, of Cornell University Exp. Station, has made an elaborate study of the Typha latifolia, in its habitats, and finds that it is the prey of twenty-five different insects representing five of the great orders of that division

of the animal kingdom. The species are distributed as follows: Six lepidoptera (butterflies and moths), two coleoptera (beetles), eight hemiptera (bugs), five hymenoptera (bees and wasps), four diptera (flies). The methods of attack and the life history of each insect have been carefully traced out. The several insects specialize somewhat as to the part of the plant that is attacked. Three moths and a bug are parasitic on the flowering head; the leaves are attacked on the surface and by leaf miners; the stalk is invaded by two of these leaf miners, but other species are not originally in the leaf. A few invade the rhizome, living largely upon the starch therein.

Notwithstanding its numerous enemies the plant is abundant in many parts of the world, and several parts of it have been suggested as possibly useful. Engler and Prantl speak of rhizome starch as a food supply, of the leaves as a source of textile material and of the pollen as a substitute for lycopodium. Claassen has investigated the question of using typha as a food product, and published his results a couple of years ago.—H. L.

Standardizing Biologic Stains.—Since the interruption of the supply of German staining materials, which were very accurately prepared and largely used, some difficulty has been found in getting uniform results with domestic products. Manufacturers have been willing to meet the demand, but the users of the stains have not always been precise as to their needs. The Society of American Bacteriologists recently made efforts to bring about satisfactory conditions, and still more recently, other societies have offered assistance. A conference was held in New York City last November under the auspices of the National Research Council, at which representatives from a number of interested organizations were present. After an extended discussion it was agreed to appoint a committee, which has since been named to act under the division of Biology and Agriculture with co-operation of the Division of Medicine. The Chemical Foundation of New York City has subscribed $500 towards financing the work.—H. L.

Domestic Manufacture of Synthetic Compounds.—The development of the manufacture of the many complex synthetics which are used in chemical and biologic research has reached a

gratifying point in the United States. A number of firms have devoted time and money to this work and the list of substances that can now be obtained without sending abroad is quite large. This work has naturally interested the German chemists, and even the work that is being done in creating an American literature has awakened anxiety in the land beyond the Rhine. A German review of Whitmore's monograph on "Organic Mercury Compounds" gives evidence of this in the sentence, "The war, which was ended three years ago, is to be carried further in scientific and industrial fields. In view of this one cannot welcome the publication of the monographs."

"Let the stricken deer go weep,
The hart ungalled play."

H. L.

SEPARATION OF DEXTROSE AND SUCROSE BY DIALYSIS.—Congdon and Ingersoll (*Jour. Amer. Chem. Soc.*, 1921, 43, 2588) give the results of experiments which indicate the possibility of a close analytical separation of these sugars by a simple dialytic method. They found that in mixtures the influence of the dextrose on the dialysis of the sucrose is such that within certain concentrations the ratio of the dextrose dialyzed to that of the sucrose dialyzed is such as to keep this ratio constant, irrespective of the proportion of sucrose in the original solution. In very dilute solutions of the two sugars, dextrose can be quantitatively separated from sucrose by dialysis in about fifty hours.—H. L.

MEDICAL AND PHARMACEUTICAL NOTES

CHAULMOOGRA OIL NOW USED IN TREATING LARYNGITIS.—Chaulmoogra oil, which has been bringing health to many sufferers from leprosy, is now used in the treatment of tuberculous laryngitis. Dr. R. M. Lukens, of Jefferson Hospital and Henry Phipps Institute, of this city, has treated patients for the past year by spraying the oil into their diseased larynges. While the treatment is not all that is to be desired, it is not unpleasant or distressing, and gives

better result than some other drugs previously used. Laboratory studies show that chaulmoogra oil does not kill the tubercle bacilli, but the tests on patients show a marked aid in healing diseased lesions on the organ that produces the sound when a person talks.—*Science Service.*

Diagnose Ills of 4000 Years Ago.—Present-day post-mortems of human beings who lived 4000 years ago and examinations of cave bears and a crocodile who basked in the sun some 900,000 years ago have revealed the medical aches and pains of those times.

Bones of ancient life have previously given medical clues to scientists of today, but the late Sir Armand Ruffer devised methods of studying the soft tissues of the Egyptian mummies that the hot sands and dry climate of Egypt have preserved for thousands of years.

The bacteria, the diseases, and man's reaction to them have not changed during the thousands of years that have passed, he found.

The inhabitants of the Nile Valley, the cradle of history, suffered from stiffening and swellings of the joints to a far greater degree and at a much earlier age than we now see this disease. A hump-backed priest of Ammon, 1000 years B. C. owed his hump to Pott's disease, which shows how little 3000 years have altered the behavoir of tuberculosis. Bacteria in these old bodies can still be stained, and traces of pneumonia can be seen. Lesions closely resembling small pox can still be recognized and studied by modern micoroscopic methods in these old mummies. Hardening of the arteries was common and severe in those days, when tobacco, excessive meat eating, modern strenuosity, and such things that nowdays are blamed for this condition certainly did not exist.

"Men were commonly stiff and old by the time they had reached fifty years, and the good old days were not so good from the sanitation standpoint," says the *Journal of the American Medical Association* in commenting on Dr. Ruffer's late work, "and we find that royalty was of very common clay, with extremely bad teeth and gums, queens bald of head, and even, we blush to say it, princesses with nits in their hair. Syphilis has not yet been demonstrated in early Egyptian bodies, a fact which may have influenced the sociology of the day. Food habits varied from time to

time and in different classes, as shown by the degree of wearing down of the teeth, but at no time did there exist those prehistoric dentists of whom all popular histories of Egypt relate, although they certainly were sorely needed."

The best mummy material obtained is that which is naturally preserved by the Egyptian climate. The Egyptian embalmers had no such supernatural skill as tradition ascribes to them, but they did remove the vital organs of the body before burial, much to the sorrow of present medical archeologists.

Even the illnesses of the dinosaur who lived many thousands of years before the Egyptians have been investigated. Prof. Roy L. Moodie, of the University of Chicago, has found pathologic lesions on the tail of this pre-historic reptile.—(*Science Service*, February, 1922.)

CARBON-TETRA-CHLORIDE PARALYZES HOOKWORM AS WELL AS FIRE.—Carbon tetrachlorid, a common chemical, may in the future replace chenopodium, the substance now used in the removal of hookworms and ascarids in man. In the last few years, millions of people in the tropics and warmer regions have been cured by modern medical methods of the hookworm disease and the work is still in progress.

Dr. H. M. Hall, of the Bureau of Animal Industry of the Department of Agriculture, has made conclusive experiments that show that carbon tetrachloride in addition to being more effective is safer and cheaper than the drugs used now.—(*Science Service*.)

ALASTRIM, A NEW NAME FOR AN OLD AILMENT.—Alastrim, a disease that resembles smallpox, is now being studied by medical men.

It was reported in epidemic form in 1920 in the Caribean littoral, Canada and England. In the present state of knowledge of its exact classification, it is being combated and reported as smallpox.

"The disease is very infectious to man; both sexes and all ages are attacked," says Dr. W. C. Rucker, of the United States Public Health Service. "No racial immunity has been observed. The disease is found in the West Indies, South and Central America,

South Africa, the Mediterranean area, and, more recently, in Great Britain. It is probable that the so-called 'Cuban itch' and 'Philippine itch' observed after the war with Spain, the mild form of smallpox prevalent in America, and alastrim are identical. The disease is highly contagious, its causal organism being spread by both direct and indirect vection. Certain observers believe that the disease is largely spread by the air; but when the enormous number of daily contacts with fellow man is considered, the assumption of this theory to account for the rapid spread and persistence of the disease seems scarcely warranted. Overcrowding helps to spread the disease. The exact classification of alastrim is still the subject of considerable discussion. It may be, and probably is, merely a mitigated form of smallpox, which, in an environment of low racial immunity, incomplete vaccination, or lowered vitality, might regain its lost virulence. It may be that the parasite is a separate species of the parent type."

The mortality from alastrim is surprisingly low. The disease is more severe in the unvaccinated and debilitated. Economically, it is important by reason of the rapidity of its spread and the temporary disablement of large numbers of persons.—(*Science Service.*)

Witches' Ointments.—In a work entitled "The Witch-Cult in Western Europe" by Margaret Alice Murray, published recently by the Clarendon (Oxford) Press, some formulas are given for ointments with which the witches were said to anoint themselves in order to be able to make broomstick flights. The work indicates the existence of a widespread cult of Devil-worship, and it is possible that the ointments were really used as a means of getting rid of objectionable persons. The author gives three formulas.

1. Parsley, water of aconire, poplar leaves, soot.

2. Water parsnip, sweet flag, cinquefoil, bat's blood, deadly nightshade.

3. Baby's fat, juice of water parsnip, aconite, cinquefoil, deadly nightshade and soot.

The original data are in old French, and it is possible that the words translated "parsley" and "water parsnip" may refer to more poisonous forms of Umbelliferæ.—H. L.

"SOLID EXTRACTS"

A single bill of paper money may carry as many as one hundred thousand bacteria. These are mostly of the type found in the intestines, but disease-producing bacteria may also be present.

The Vermont Experiment Station has recently shown that the number of thorns which a blackberry vine produces is determined by the amount of light which is receives. Plants grown under shade produced only a few weak prickles, while those grown in full sunlight produced their full complement of very stiff, stout spines.

CALORIFIC VALUES OF CEREALS.

(Calories per pound.)

Oat flour	1795
Rye flour	1660
Rice flour	1645
Barley flour	1640
Corn flour	1630
Wheat flour	1620

It has been demonstrated at the University of Minnesota that there are at least twenty-five distinct varieties of the stem rust of cereals and grasses.

It has been found that salts of lead, in very small amounts, will stimulate plant growth.

Spider silk is used in telescopes and various other optical instruments to indicate by cross lines points in the field of vision. Many attempts have been made to substitute spiders for silkworms in the production of silk for general use, and a small industry of this description exists in Madagascar.

A recent note in *Science* records what is believed to be the temperate zone record for a single season's growth of a shoot of the tree type of woody plant. This phenomenal shoot grew from the

stump of a beheaded Paulownia and reached a height of 21 feet 6 inches, a circumference of 10 inches at the base, and had 24 leaves, one of which, measured in late July, was found to be 38 inches long in the largest dimension.

A radish will turn its leaves toward a source of light no stronger than that of a candle twenty-five feet away, while one of the cresses is similarly sensitive to light of a strength equal to that from a candle about one hundred eighty feet away.

It will come as a surprise to many people to learn that, at the present time, the United States produces much more radium than all the rest of the world together. From the beginning of the industry in 1913 to January, 1921, approximately 115 gm. of radium element were produced in this country. Probably not more than 40 gm. have been recovered from foreign ores since the discovery of radium by Madam Curie.

For many years radium was exclusively produced from the Austrian ores at Joachimsthal; later, it was obtained from pitchblende deposits in Cornwall, and from autunite deposits in Portugal. About nine years ago, officials of the Bureau of Mines found that the carnotite deposits in southwestern Colorado and eastern Utah represented the largest bodies of radium-bearing ore in the world.

Some very sensitive tendrils will respond with a curvature to the friction produced if a bit of thread weighing about one hundred-millionth of an ounce is being blown across it by the wind.

The Abbe Theodore Moreaux, Director of Observatory at Bourges, has recently given some estimates of the age of the earth and when the phenomenon of life appeared on it. He considers 500,000,000 years about right for the age of the earth and he thinks that the temperature dropped to a point where life could exist about 250,000,000 years ago. Man was a comparative newcomer and the Abbe gives only some tens of thousands of years, thus refuting an estimate of a German scientist, who recently gave 40,000,000 years as the probable period for the advent of man.—*Scientific American.*

NEWS ITEMS AND PERSONAL NOTES

Decease of William P. Clothier.—A veteran graduate of the Philadelphia College of Pharmacy passed away recently in Buffalo. Dr. William P. Clothier was one of the oldest practicing pharmacists in western New York. He was born in Philadelphia in 1839 and studied pharmacy and graduated there in 1861, when he went to Buffalo and graduated in medicine at the university of that city.

Popular Lectures at the Philadelphia College of Pharmacy and Science.—That this innovation met with the instant success which the project merited is amply proven by the large audiences which have attended all of these lectures. The audiences are diversified in their nature, each lecturing topic calling for a select group of interested auditors. It is the intention of the College to continue annually similar series of popular science lectures.

Prominent Citizens Address the Student Body On Citizenship Topics.—A series of lectures on citizenship has been arranged for the benefit of the student body of the college. Men prominent in the promotion of civic and national betterment have been chosen to address the classes. Some of the lecture subjects are: "The Evolution of Government," "Municipal and State Political Organizations," "Democracy and the Individual Crowdmindedness," "Character as a National Asset."

An Educational Exhibit.—The annual report of the National Museum of Washington, D. C., for the year ending June 30, 1921, devotes considerable space to the description of a biological exhibit of the H. K. Mulford Company products, recently installed in the Smithsonian Institute.

The article deals at length with Antitoxins and Vaccines for the prevention and cure of infectious diseases, all of which are illustrated in this unique exhibit.

The exhibit, which is the only display of biologicals in the museum, is located in the East Gallery. It comprises a number of cases containing specimens of Smallpox Vaccine, Diphtheria Antitoxin, Bactericidal Serums, Rabies Vaccine, Serobacterins, etc.

In addition to the specimens, photographs are shown of the various processes used in the Mulford Laboratories, also colored transparencies and charts.

The exhibit is strictly an educational one, and will prove of great value to physicians, pharmacists, nurses and other visitors.

Visitors to Washington should, by all means, endeavor to pay the exhibit a visit, as it is undoubtedly the most complete biological exhibit ever assembled, and one of the most attractive and interesting of educational exhibits in the institution.

BOOK REVIEWS

"Elements of Fractional Distillation." By Clark Shore Robinson. McGraw-Hill Book Co., Inc., 1922.

This volume in the International Chemical Series fills a place in the working library of the chemist who must give advice along engineering lines. Fractional distillation is discussed from the point of view of the Phase Rule, and from the standpoints of the production manager, the designer, and the manufacturer of such equipment. Forty-seven pages of tables and the corresponding bibliographies are given as an appendix; these tables contain a good deal of data not readily available. The author succeeds in dealing with the subject theoretically in a satisfactory manner while escaping the biases that sometimes follow such treatment. Thus on page 95, after arriving by theory at 45 as the proper number of plates to be used in a perfect column for separating benzene and toluene, he states, "A 45-plate column would, however, be excessively high for practical purposes, so under the circumstances, a shorter column would be used, say 36 plates." A few errors may be found by the careful reader, but they are not such as to reduce the usefulness of the book to an intelligent person. Thus on page 102, when discussing "Film Coefficient Water Side," when $V = 10.0$ ft. per sec., k_3

is given a value which is not the value that results from the formula supposed to have been used. This affects the value for $\frac{1}{K}$ in the center of the same page. Such errors are not surprising in the first edition of a detailed work.

In general, the book seems to be well adapted to use in practice as well as in detailed instruction in this branch of chemical engineering. The writer has given us a book that measures up to his stated intentions. It does not replace any older book known to the reviewer, but stands out as a unique contribution.

D. W. Horn.

OFFICIAL CATALOGUE OF STANDARDIZED PLANT NAMES IN PRESS.

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EDITORIAL

THE LIGHT IN THE WINDOW AT EIMBECK.

To the traveler in the province of Hanover in Prussia, who is fortunate to come upon the quaint little settlement of Eimbeck, is pointed out the spot where not so many years ago an inquisitive apothecary unravelled the mysteries of opium and gave to the world the story of morphine, the first of the alkaloids. The apothecary, Friedrich Sertürner, so we are told, was not an overlearned man. He could write after his name no trail of dignified capitals, and his training in science had come to him not because it was forced upon him, but rather because he had yearned and struggled for it. His Gamaliel was Experiment and his University Experience. And yet, "unlettered, unsponsored and unread," he "opened the way to a vast domain of medical discoveries." Situate on a corner where alley met main street, this famous apothecary shop but looked the counterpart of scores of similar "concessioned" establishments in that province of Germany. Unpretentious and perhaps meager stocked but smiling with cleanliness and beaming the story of Frau Sertürner's neat custodianship, the little shop catered to the drugstore wants of a stolid community.

Out of Eimbeck no one knew or cared to know what went on inside its walls, and the townsfolk themselves cared but little so long as they could promptly get their herbs and simples when they needed them.

But somewhere back of the overvarnished and grotesquely carved partition the apothecary himself might be seen, early in the morning and very late at night, working by the fitful light of a malodorous whale oil lamp, puttering with muddy extracts and decoctions of strange Asiatic drugs. Crude was his equipment and meager his apparatus, but he worked on incessantly. He worked on and on un-

til the gossipy red-nosed men that lounged at the inn-front across the alley began to whisper forebodings of disaster to his well-established business. Frau Hohenlohe, an over-friendly neighbor, confided to Hausfrau Sertürner, as only women can, that the good *apotheke* was in danger of losing his concession unless he quit "playing with experiments" and tended better to business, for had he not one day kept the Colonel of Hussars waiting a half hour for a draught of *braus-pulver* while he, the *apotheke,* mussed about in inky vials of vile imported drugs torturing them with fire to seek their essence.

And so it was that the good housewife cautioned her partner to mend his ways and secured from him a promise, readily granted and as readily broken. For the next morn, so the story goes, before the sun had rubbed the cloudlets from its eyes, Sertürner was again at his beloved experiments seeking from the crude and dirty opium the essence that gave it its soothing virtues. A tinkling of heavy glassware, the bubbling of boiling extracts and the thumping of pestle in mortar broke harshly on the peaceful reveries of the morning hours and the half-awakened village blacksmith on his way to labor pointed in wonderment to the light in the dormered window of the *apotheke* shop, for here was a man who could but would not sleep even in the morning when sleep is sweetest. But the blacksmith little knew that the light of that dormered window would shine on into everlasting centuries and that the pathway of science would be greatly brightened by its penetrating beams.

For on that same morning borrowing a leaf from the book of the mathematical Greek, Sertürner aroused the neighbors with his joyous cries of *Eureka! Eureka!* and the discovery of morphine, long searched for by many and many a chemist, had become a fact.

Shortly afterwards (1806) Sertürner announced his discovery of "*opium-saure*," later called meconic acid, and explained how it was combined in the drug with an alkaline base, which he called "*morphium.*"

His report amazed the scientific world of that day and its importance was fully recognized when France later awarded to him a substantial monetary prize for "having opened the way to important medical discoveries by his isolation of morphine and his exposition of its character."

Thus it was that out of the modest apothecary shop in Eimbeck of Hanover, came the story of the first alkaloid, the herald of an

unending trail of like substances that have been since made known and utilized to the benefit of mankind. Sertürner had certainly "opened the way," and no better compliment than this can be paid to any worker in the ranks of science.

But today *They* tell us that no more epoch-making discoveries can be made by the untutored and plain. They tell us also that it is the day of the finished scholar, of the precisely trained, and that one can have no hope to reveal discoveries and attain inventions unless tedious and prescribed penance has been made at Gamaliel's feet. They say that the age of genius is past and the day of the college bred and college trained man is here. Truth today makes its nesting ground in the well-appointed laboratory and in the elaborate establishments of endowed institutes of research and only the anointed shall seek and find it there. The cradle of nature no longer holds it. But yet, when we seek into the story of yesterday, Archimedes was sequestering in a marble bathtub when he eurekaed upon the truth of relative density. Galileo was seeking solace from the noisy incantations of a tiresome priest by watching the swinging chandelier, and then it was that he evolved out of the phenomenon an understanding of some of nature's first principles. Isaac Newton found explanation of the law of gravitation in the laboratory of the apple orchard when an apple "obeyed that impulse" and letting go its scant hold on a twig landed squarely upon the dreamer's head. And we might mention many other similar giants of intellect and benefactors of posterity, untrained with slide and test tube, whose knowledge of calculus and trigonometry was microscopic and who paraded no alphabetical curlicues after their Christian or un-Christian names.

But our asserverations need no further corroboration. Archimedes, Galileo, Newton, Pasteur, Sertürner, Scheele, Procter, and a host of their kind come with us to state that prerequisites to the capacity to serve lie not in the over-emphasis of academic attainments but rather in the intuitive spirit of research born only in men who have the proper mental receptors and have inherited "the inner eye," which according to the poet is "the joy of solitude."

Imbued with this spirit are many men here and there over our land who lend no ear to the loud protestations of the university or college fanatic, but who toil on in apothecary shop, in foundry or out in nature's laboratory, eagerly searching for some new phase of old, old truths and anxious to interpret it to a waiting world.

The day of the genius is still here and ever will be here, and out of the orchard, the church, the home, the humble apothecary's shop shall doubtless come again many, many discoveries that shall have baffled the ken of men who have come out of the mills of the learned, but having eyes see not. I. G.

ORIGINAL PAPERS

ONE DROP OF BLOOD.*

By Ivor Griffith, Ph. M.†

The story of one drop of blood is the story of life. This is a story that has never yet been told. It is a story that man will never be able to tell. A physician of the old school once told a group of us open-mouthed youngsters of his Sunday school class that he was in fear lest some blundering scientific idiot should come upon the secret of life some day, and so bring upon the human race the wrath of a Creator whose most precious device and invention had been understood by a mere creation called man.

Physicians and scientists of the new and so-called advanced schools think not in this respect, for in our newspapers of a few days ago we read of a man named Carrel who in his search for this philosopher's stone, has known how to keep a fragment of a chicken embryonic heart growing and thriving in an artificial atmosphere. Alexis Carrel, this wonderful man of science, is quite able with his invigorating and life-sustaining media, to cause this fragment of embryonic tissue to add cell after cell to its structure, and so rapidly that daily portions must needs be dissected off, so that the tissue growth does not overflow its container. But each cell that divides and gives two to the tissue, only adds to Carrel's dilemma.

As the cells multiply, so do the troubles of Carrel, and the distance to a discernment of the secret of life becomes proportionately further. The secret of life lies not in its promotion and further-

*One of a series of Popular Lectures, given at the Philadelphia College of Pharmacy and Science.

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ance and sustenance, but rather in its origin. Whence comes this subtle thing called life—not what is Death's antidote? Our old physician Sunday school preceptor was old-fashioned enough to teach us that this latter has been man's to own since a gray morning in Nazareth.

And so we say that the story of life is the story of a drop of blood, yea the story of one blood cell. Thus do we also apologize for the seeming disconnection of our presentation and for its incompleteness.

To present a subject such as this popularly, we are told that we must sacrifice cold scientific facts, and offer instead a collection of easily digested and tastier morsels. To refrain, as it were, from the meat of the subject and serve the less nutritious but more salubrious and assimilable delicatessen. And so to the front counter.

In order to have some semblance of regularity to our discourse we ask you to accept these landmarks and to allow us thus to divide your consideration of this topic:

Physical characteristics.
Chemical characteristics.
Microscopic characteristics.

We also ask you to consider the blood of which we speak as human blood, unless otherwise stated.

Like every good preacher, we faithfully expect to wander from our text with regularity, and carry you with us to fields quite remote from these infenced pastures. We speak of one drop of blood in the title. It is of blood regardless of volume that we speak throughout the lecture. What does the dictionary say of blood? "Blood is the fluid which circulates in the arteries and veins of an animal." So answers one with brevity and conciseness. But what of its nature and its functions?

Blood is a tissue, an organ of the body, quite as distinct as the liver or the heart or a muscle. It is a wandering tissue so important to the economy that it can never stay long in one place, but must unceasingly travel through its sinewy canals to perform its endless obligations. It is the most vital tissue in the body.

The blood is the military establishment of the Kingdom of Animal. And it is a military establishment that is perfect in every

detail as long as health rules. The realm of Wilhelm with its military perfection boasted of no system such as we have in this fluid army.

Consider it a while. Its purely defensive and aggressive organization. Its Militia, its National Guard, its Home-Defense Corps—the hosts of white cells ever ready for attack. Its Service of Supply—the red cells everlastingly carrying the oxygenated munitions and the simplified protein molecules to the organs needing them,. and conveying back the unwholesome gaseous material that the tissues wish to be rid of.

The Quartermaster's Department—the serum with its hidden hormones, its endless enzymes, its aggressive agglutins, its limpid lysins, its opened-eyed opsonins, its fighting antitoxins—ever ready to deliver these agencies wherever needed. Its Intelligence Department, so reliable that a pin prick on the finger tip is sufficient impulse to have a detail of leukocytic scouts there in two minutes, to survey the ground and offer resistance to infection if necessary.

The Sanitary Corps—the serum again that conducts to the kidneys and thence to excretion—the various poisons and wastes that are eliminated by tired organs, and by over-exercised muscles. Its Medical Department with its commissioned Pharmacy Corps that is always responsive to emergency. Let the liver get torpid and sluggish through its owner's indiscretions, and the message is carried on a trunk nerve to headquarters. Comes a call for calomel. Ten one-tenths and into the stomach it goes, to find the first aid department of the blood stream ready to convey it while the pharmacy corps prepares it, so that by the time it reaches the torpid liver it is in the precise form for the exercise of its duties.

Then again its Engineering Corps. A staphylococcus with an impertinent turn of mind alights on a professor's collar. The collar made by Dupont is too slippery to suit it, so the naughty germ jumps over to the skin on the back of the neck. Now the staphylococcus is a mean germ, and its meanness is accentuated by its multiplication factor. Given one staphylococcus in a suitable environment, and by the next day the one becomes a million. Now this particular staphylococcus on the professor's neck ambles over to an intracellular air space and proceeds therewith to multiply. With its multiplication comes arrogance and it becomes conceited enough to establish a permanent home for old and indigent staphylococci. For

once the intelligence department of the blood has been derelict in its responsibilities, and before a message of succor reaches the commander of the white cell army, the staphylococci have been able to entrench themselves securely, and to offer formidable opposition. But at last the battle summons reaches the white cell host, and from every direction they stream in endless array to the conflict. The battle of the Boil begins in earnest, and the patient professor suffers in agony while the turmoil of war goes on unceasingly.

Here, perhaps, a squadron of germs hard presses a battalion of white cells, but on the left the bugs are falling back and the phagocytic cells wreck havoc among them. The tide of battle sways. Meantime the boil, so called, swells and matures to a livid yellow mountain, and the professor wears a silken collar. No chemistry for the boys today, and the boys, as boys will, wish luck to the pestiferous parasites.

But wait, what goes on beyond the field of battle? Why is it confined to the neck—that body Belgium? Ah! but what of that engineering corps of the fighting blood. Back of the field of battle they are there valiantly working, and their allotted task is the building of a wall which shall confine the onslaught to a certain area and stay its poisons out of the body proper. If the white cell engineers succeed in building the fort, the blood stream keeps wholesome and uncontaminated. If the engineering corps fails in its work, there comes what we call Blood Poison. The germs victoriously enter the sacred system and through the portals of bacteremia, septicemia and pyemia comes the dreaded spectre of Death and Dissolution. But happily this is very seldom the case for the Engineering Corps is usually very efficient. The abscess is completely walled off, and the staphylococcic host is denied its sustenance, starvation and decimation thin their serried ranks, the boil bursts, a tribute to the ingenuity of the sappers and miners of the blood stream. I'll grant you that in this terrific battle much sacrifice is made, for millions upon millions of the killed white cells are the penalty which the body pays for its safety. The bursting of the boil is the signal of victory. Presently this staphylococcic Waterloo is only marred with a ragged scar, and the neck once more enjoys the placidness and peace that knows only the disturbance of a crinkled wash rag or a serrate linen collar. The beloved professor once more faces his class and without a rigid neck.

Thus it is that the manifold duties of this martial tissue of the Kingdom of Animal keep it ever on the alert. Even in days of peace do we find the corps of engineers busy. An accident befalls the host. A finger or a hand is amputated. Blood canals are severed from the body, and who shall build new channels for the fluid's passage? The hand is amputated at the wrist. And will the severed artery spout blood and impoverish the system and bring it to its destruction? No, for the surgeon ligates the veins and arteries, seals their end as it were. But this does not, we must remember, make for circulation. So promptly the engineers of the blood, the physiologist's wandering cells, commence to build communications so that the network of military routes shall be re-established and that the nourishment of the stump may be sustained and made accessible to the throbbing stream of blood. The surgeons and anatomists call this anastomosis. We call it an engineering feat. Emergency pontoons so constructed that they last a lifetime.

How seldom we pause to give thought to some of the processes which daily occur in our lives. How little we seek to know of the pleasure that comes with understanding something of these commonplace things of life. A fairly deep cut into our flesh, and out gushes the crimson stream. But promptly the gush modifies to an ooze, and almost unnoticed the dripping ceases and the cut is tightly soldered. Why did not the flow continue, and what providential agent came to stop the leak? It is the plumbers of the blood stream, who, for plumbers, are fairly prompt and seldom fail to come when we call them. And also the plumbers of the blood stream never have to go back home for forgotten tools.

There are a few unfortunates, however, in whom the plumbers are lacking. Such persons are known as hemophiliacs, and are dangerous operative risks. The mechanism of coagulation is not definitely known although certain hypothetical theories are generally accepted. Most prominent is that of Jules Bordet, who states that elements from the blood serum, which he collectively calls serozyme, as well as from the cells and platelets which he denominates cytozyme, unite to form a substance called thrombin, which in turn unites with the fibrinogen of the plasma to form fibrin or the clot. Contact of the blood cells with tissue walls and the presence of calcium hastens the union of the serozyme and cytozyme to form the thrombin. Coagulation normally occurs in four to eight min-

utes. Clotting is more rapid where pressure is exerted on the puncture or cut, so that the technician in testing for this factor must avoid any undue pressure but rather let the blood flow of its own accord. This is also why some workers prefer to withdraw blood directly from the vein instead of by puncture.

There are certain artificial blood coagulants that promote clotting of the blood. Chief among these is the kephalin type, usually a tissue extract (calves' brains).

The determination of the coagulation time of blood is part of laboratory procedure, and is done in many ways, none of them accurate in the strict sense of the word. Sufferers from jaundice show a high coagulation time. For certain purposes, notably in blood chemistry, it is desirable to prevent blood clotting *in vitro*. This may be accomplished by directly receiving the blood into a 1 per cent. solution of sodium citrate or fluoride, powdered or dissolved oxalates. The chemistry involved here is that these substances precipitate and render inert the calcium salts which are so essential to coagulation.

The average healthy adult carries on his or her person quite a burden of blood. This tissue represents approximately one-twelfth to one-fourteenth the weight of the body. Blood volume varies, however, even in health, and that is one reason why hematological laboratory findings are never actually reliable unless calculated from the arbitrary cubic millimeter unit to the actual volume content, which is obtainable by certain physical methods. However, for usual clinical observation blood volume is disregarded. Thus a person weighing 120 to 140 pounds has a blood content of about ten pints or as much blood as might be contained in five quart milk bottles; rather a formidable figure when we think of it in this way. With this knowledge we must bear in mind that when we desire to emphasize the seriousness of an operation a la Irvin Cobb, we must no longer quote the doctor's "Oh, you lost a whole pint of blood," but rather let us say: "Dear me, I lost almost a gallon of blood." That sounds more like a hospital anyway.

Also we need not disbelieve the blood donor who boasts of having furnished at odd times and for adequate compensation a pint or two of blood for transfusion to an anæmic patient.

Incidentally let me make you acquainted with a new American profession—namely that of the peripatetic donor of blood. He is the

man, generally in his twenties, when the ratio between blood and sense is at its ebb, who leaves his name and address with every hospital laboratory, who will furnish for transfusion a pint or a quart of blood once every two weeks. This may seem unbelievable, but we know of many such persons who render this service quite regularly for a time, and so obtain their living. Moreover it has been our observation that this continuous depletion of the stream of vitality always leaves its impress behind on the donor, or rather the seller of blood. For although nature replenishes the quantity of blood each time the blood is used, it is well known that the quality of the blood is impoverished in a great many respects.

I have refrained from mentioning the fact that transfusion of blood from one person to another is not to be done empirically for the reason that incompatibility may exist between donor and recipient. Preliminary tests are made on both in order to establish their types and to preclude the possibility of mixing inharmonious bloods. The nature of these tests, and the various theories in regard to grouping bloods are too broad and far-reaching to be discussed here.

Physically blood is composed of four types of basic elements held in suspension in a liquid called the blood plasma. These four form elements are the red corpuscles (which the pedantic call erythrocytes), the white corpuscles called leukocytes, the blood platelets and the so-called blood dust or hæmoconien. These substances represent from 40 to 60 per cent. by weight of healthy human blood, and the serum or plasma represents the rest.

Ordinarily blood is a dark, red opaque fluid due to the red corpuscles. Through the action of certain agents, however, it may be rendered transparent. Water, ether, and certain bacteria are capable of doing this, and blood so altered was formerly said to be laked. Now we use a more high-sounding term, namely hemolysis, and the agents are said to be hæmolytic agents.

Hemolysis simply means a disruption of the red cells with the liberation of the pigment hemoglobin which they contain.

The specific gravity of blood varies between 1.045 and 1.075. This may account for the old line that blood is thicker than water. Oddly enough it varies with sex, the blood of males having a higher density than the blood of females of the same species. In sickness

this factor often changes to a marked extent, and according to the poets with advancing age, for Shakespeare says that

> "The hairs on his brow were silver white,
> And his *blood was thin and old.*"

Although correctly this really refers more to viscosity than specific gravity.

The reaction of the blood, formerly held to be distinctly alkaline is now stated to be neutral, with an infinitesimal leaning to the alkaline side. And this only because the combining power for acids is greater than it is for alkalies. One authority states that, "Our blood has a remarkable capacity to preserve its normal slight degree of alkalinity, to escape at the same time the *Scylla* of hyperacidity and the *Charybdis* of excessive alkalinity. This wonderful capacity for self-adjustment and preservation of its optimum conditions for the purposes of life is a typical instance of the innumerable fine mechanisms of self-adjustment in the body, all aimed at maintaining the most favorable environment for the functioning and preservation of life—self-adjusting mechanisms which in fact comprise for the scientific investigator the most impressive points of difference between living organisms and the lifeless world. And yet this remarkable power of the blood to maintain its normal alkalinity has been elucidated in a very complete way (especially by L. Henderson, of Harvard University) by the application of simple principles of physical chemistry to the study of the composition of the blood: There are chemical 'buffers' present, which act chemically to preserve neutrality exactly as powerful springs act as mechanical buffers to minimize the shock of impact to fast moving bodies."

Blood serum, or the liquid portion which separates when blood is allowed to stand, contains a number of complex organic substances as well as a few inorganic salts. These substances consist of almost 8 per cent. of its weight. Of the organic substances fibrinogen, referred to under coagulation, is the most important; and of the inorganic sodium chloride, sodium bicarbonate and certain phosphates are the most important. These salts are very important elements in the make-up of the blood, and play pivotal positions in the functionating of that tissue. For instance, were it not for them the corpuscular elements would swell and disrupt.

Their function as buffer substances in regulating the reaction of the blood is fairly well known today, although there is much

about this mechanism that is not known. May I suggest rather a far-fetched query at this time just to show how peculiarly the blood enters into the body working? Why do we puff after strenuous exercise? Here is the accepted answer. The respiratory centre (the lungs, etc.) is extremely sensitive to the minutest alteration in the reaction of the blood toward the acid side. Now muscular exercise produces in the blood and tissue a slight increase of carbon dioxide, which is acid in its nature. Increased ventilation of the lungs, however, removes this carbon dioxide, thereby bringing the reaction of the blood back to normal. Increased ventilation is simply another name for puffing. There is much more that could be said about these peculiar and interesting blood functions, but it would only be at the expense of overlooking some facts which may be more basic and elemental.

As was stated the color of normal blood is due to presence of hemoglobin in the red cells. In arterial blood this albuminous substance is in combination with oxygen and is here termed oxyhæmoglobin, hence the scarlet blood of the arteries. In the venous blood there is both hemoglobin and oxyhæmoglobin, this accounting for the bluish color of venous blood. Blood color changes with certain diseases, such as scurvy, etc., but more so in the wake of poisonous substances. Coal gas or illuminating gas containing carbon monoxide changes the color to a vivid red due to the formation of carbo-oxyhæmoglobin.

With potassium chlorate, aniline, hydrocyanic acid and certain other agents the color becomes a murky red to a chocolate. Certain of the coal tar derivatives also possess the power of destroying the red blood corpuscles. This accounts for the livid color of headache powder dopes, and acetanilide habitués. In extreme cases of leukemia it becomes milky, due to the presence of a vastly increased amount of white cells. Of hemoglobin we shall have more to state later on.

Of the chemical aspects of blood the medico-legal aspect is probably the most interesting. The decision in many a murder mystery has hinged upon the positive identification of blood stains. These forensic problems are particularly difficult to solve where a stubborn jury is to be convinced that the blood stain upon the axe or the hatchet or hat pin or what not is human blood and not animal blood. Annals of the courts often record such cases. In a Camden court some time ago, we are told that such a case was tried, and the

prosecution for safety's sake had brought to court all of the chemical paraphernalia surrounded by a chemist, so that the jury could be shown and be convinced that the stains in question actually were human and not goat blood as the defense claimed. Unfortunately the chemist being human, could not stand the concentrated stare of a dozen jabbering Jersey jurists and in his excitement he got things a bit mixed, so that the outcome of the test apparently proved that the stains were neither human nor goat blood. The case was thrown out of the court—so was the chemist. But of course strange things do happen in Camden.

Another story recently appearing in a fiction magazine, tells how a murderer's identity as an Australian was established by the ability of a physiologic chemist to prove that certain stains upon the handle of the murder weapon were kangaroo blood, and the blade stains were human or the victim's blood.

Of the forensic tests for establishing the identity of human blood the most certain is probably the physiological precipitation test. This test is based upon a fact well established in serum pathology. It has been proven that the serum of an animal injected with blood or blood serum of another animal, shows the property when added to an homologous serum of precipitating the protein of this serum as a light, feathery precipitate. This is a specific reaction indirectly similar to the Wassermann test. Thus if we inject a rabbit with human blood at certain intervals, the serum from the blood of the rabbit will afterwards have the property of precipitating the albumin from a suspension or solution of human blood, and will not precipitate goat's, camel's, or other blood. The one fallacy (and let Darwin disciples in the audience gloat over this) is that the blood of anthropoid apes acts exactly the same as human blood. However, that element may be usually excluded, and the law now recognizes this test when positive, as reliable in differentiating human blood from that of domestic animals. Strictly chemical tests, but not at all specific, are the guaiac or benzidine tests, which are used as routine tests in the laboratory for the detection of occult blood.

Another test, known as the Teichmann test, which has for its end result the separation of hæmin crystals from the blood. The spectrosrcope is often used in the detection of blood, but its value is limited. While we have not carefully considered the chemical

aspect of blood we must not pass by without mentioning one blood constituent that has ever been the hallelujah chorus of the patent medicine man, and the oft recurring sing song of the nervous thin-blooded patient. We refer to iron. Witness the pages of a Philadelphia newspaper which nearly everybody reads, and in huge captions a quack medicine advertisement advises us when weak and run down to eat a certain brand of iron pills, the same identical brand that Willard fed upon when he floored Jack Johnson. Oddly enough, when Dempsey later floored Willard, the advertisement gave Dempsey credit for eating their pills. Then again comes a California group of fruit growers with the startling discovery that it is the iron in raisins that make them worth while as a tonic, and the sub-urbanite is glad to find a logical pretext for carrying home the five pounds of raisins for which his formulas call.

As a matter of fact there is very little iron present in the entire blood volume. One might approximately state that there is just about sufficient iron to constitute the bulk of two small carpet tacks (or about 35 grains).

This does not infer, however, that a diet of tacks would be in any way beneficial, although except for traumatic considerations, it is quite conceivable that the self-diagnosed anæmic person would benefit quite as much by swallowing the tacks as by swallowing a bucket full of some of the patent forms of iron sold as blood purifiers and builders. When the blood needs iron, and it sometimes does, the best way to bring the two together is now alleged to be by the hypodermic injection of assimilable iron compounds. It is known, however, that certain forms of iron taken into the stomach act favorably on general blood characteristics. As a matter of fact in chlorosis the administration of iron affords one of the most brilliant examples of the specific action of a medicine. More recently Germanium oxide has been advanced as a hæmogenetic and is alleged to be far superior to iron and arsenic in that respect.

The microscopic characteristics of blood are diversified but well studied. As previously stated there may be seen in blood when examined under the microscope four form elements, the most important being the red cells and the white cells. Each cubic millimeter of a healthy man's blood normally contains about five millions of the red cells and about four and one-half millions for the same unit of a woman's blood, and about five to seven thousand of the

white cells. This means that one drop of a healthy man's blood contains about 300 millions of the red cells. Not to be outdone by our city statistician we are venturing further to state that a healthy adult contains in his whole blood stream twenty-five thousand billions of these little cells. Following along conventional lines we further state that if these little cells from one man's blood were arranged side by side, microscopic as they are, they would constitute a ribbon that would completely encircle the earth and still leave enough to tie a handsome bow. There are, of course, variations from these figures that are normal. And again there are variations that indicate morbidity. Thus we have in phosphorus poisoning counts as high as eight to nine million red cells and in pernicious anæmia counts as low as half a million. Persons living at high altitudes likewise show abnormally high red blood counts. In the Cordilleras we are told that the natives show counts of eight millions per cmm.

The red cells of human blood are circular, biconcave discs about one-three-thousandths of an inch in diameter and about one-twenty-five-thousandths of an inch in thickness. In infancy larger and smaller forms are found even in health, but in the adult the predominant characteristic of the erythrocytes is the persistent uniformity of shape and size. Departure from this uniformity indicates morbidity.

The peculiar biconcave shape of the red cell has never been satisfactorily accounted for. Physiologists differ as to the source of origin of the red cell in fœtal life, but during the period of growth and adult life they are agreed that the cells are developed from nucleated cells called erythroblasts, which are formed in the marrow of the bones. These blasts multiply by a process called karyokinesis and gradually become changed, with the vanishing of the nucleus, into the red cells. Thus it is after a hemorrhage or when the blood is regenerating, that we find some of these nucleated red cells in the blood picture and this is to be interpreted as a favorable sign. The period of life of the red blood cell is said to be about three or four weeks, so that we may assume that there is a continuous regeneration of these cells going on in the healthy blood stream. And we may also state that the grave of the red cell is the liver, so that its gay career starts in the marrow and ends in the liver.

Blood regeneration after a hemorrhage is very prompt. Even after a severe loss of blood in man, Lyon found that in three weeks' time restoration was complete. The erythrocyte owes its color to hemoglobin and oxygenated hemoglobin. Hemoglobin belongs to a class of bodies known as chromo-proteins and because of its ability to combine loosely with certain gases, thus promoting the gaseous exchange of the body, it is styled a respiratory protein. It is the iron in hemoglobin which enables this pigment to exert its vital power of oxygen transference. Normally human blood contains about 14 per cent. of this pigment. Actually the figure upon which computations of hemoglobin blood content is based is 13.77 of hemoglobin per 100 cc. of blood. This figure is arbitrarily termed 100 per cent. hemoglobin and the standard hemoglobinometers such as the Sahli are computed to this unit.

Pale or colorless complexioned people frequently but not always lack this pigment as well as the red cells, athough we frequenty find that the cells may be present but with the pigment lacking. In chlorosis, for instance, each cell shows less hemoglobin than normally, although the number of cells may be normal. In pernicious anæmia, on the other hand, the cell content of pigment may be very high, but with a low cell count. Thus it is that the laboratory examination of hemoglobin is an important part of the hematologist's work, and an important aid in establishing diagnoses.

The main function of the red cell as we have previously stated is to promote the gaseous exchange in the body—to carry away the noxious gases and to bring back the life-giving oxygen. The white cells or the leukocytes are the fighting soldiers of the blood stream. There are several types of white cells, all nucleated, and they may be generally classified into two groups, the one where granulations are present in the protoplasm and the other where no such granulations exist. Further classification is made according to the peculiar affinity which the granules may show toward certain acid and basic aniline dyes. Normally the blood contains about one white cell to each 1000 red cells. In disease the ratio changes usually with an increase in the white cell count. Thus it has been noted that in cases of pneumonia ending in recovery, the blood generally contains a greatly increased number of leukocytes, while in fatal cases the white cells were in normal number. This fact was particularly noted during that famous, or shall we say infamous, epidemic of flu.

It is for this reason that enumeration of the white corpuscles of the blood is now a potent factor in the diagnosis of disease. In appendicitis, for instance, the white cells increase three or fourfold and particularly so if that unloved and unwanted part of the anatomy is flirting with an abscess. The absolute count as well as the differential counting of the leukocytes is the common routine procedure with every hospital patient in these hectic days of laboratory diagnosis, and we sometimes feel that the tube and the slide has almost entirely replaced the mind and the eye of our good friend the doctor.

The white cell possesses amœboid motion, which the red cell does not, although the latter does possess some molecular motion. The white cell is also frequently phagocytic, that is it has the power, happily for us, of destroying bacteria by encircling and cannibalizing them. Not only that, but we are told that blood invading bacteria become weakened in their vitality just at the sight of a white cell, that is before phagocytosis begins. This may be demonstrated in a most interesting fashion under the microscope. There is a comely parasite to which the scientists give the following abbreviated designation, Hemogegarina stephanovi. This parasite has a peculiar nonchalant gait when it traverses familiar by-paths, and fortunately for us its habitat is in the blood of reptiles and not in the blood of man. But when it invades the blood stream, and happens to step in the road of a trouble-seeking white cell, it gets languid and loses its familiar confidence. Just as soon as the leukocyte comes to its field of vision, it becomes stiff and stretches out, scared stiff as it were. After a few seconds large vacuoles appear in its nucleus. The white cell at once sets to work to surround its victim, and five minutes after the accidental meeting, our friend the parasite has been completely englobed by the leukocyte. This phagocytic index, or the capacity of the white cell to consume germs, is now measured in the laboratory so that we can definitely establish a patient's power of resisting or overcoming infection by counting the average number of certain bacteria phagocyted by the polymorphonuclear white cells.

A word in regard to the blood platelets. The significance of this element is still in doubt. They have long been known, however, to have some bearing on coagulation, and are the only elements whose disintegration is to be seen in the coagulation of normal blood. When

coagulation is observed under the microscope the fibrin strands are seen to start from groups of the platelets.

The blood dust of Müller (hæmoconien) consists of fine granules which have a vibrating motion. Little is known of them and they are given scant consideration in clinical blood examinations. The suggestion has been made that they are granules from disintegrated white cells.

Of the lymph or plasma we hesitate to speak since there is so much to say and so little time in which to say it. There is after all but very little known about blood functions that seem to reside in the serum or plasma. Empirically we think our information is considerable, scientifically it is very scarce. When after exposure to infection the first line of defense wavers and the infectious agent creeps progressively onward, when the barriers of the second line are broken through and a complete invasion of the blood stream is threatened, what then? Host after host of white cells pour in mighty cavalcades and valiantly fight the invader of their homeland. But the toxemia induced by the bacterial invader may be so intense as to overwhelm the white cell army, and what then? Out of a mystic somewhere in the plasma flows a magic fluid that paralyzes, precipitates, dissolves, agglutinates or otherwise disarms the intruder. Scientists call these special properties and constituents of the serum, agglutinins, precipitins, bacteriolysins, antitoxins, etc., knowing them at least by their deeds even if unable to identify them as separate entities.

Sometimes, of course, even this last line of defense is insufficient to curb the progress of disease, and the human organism is forced to succumb and to be conquered, and the penalty of conquest, and complete conquest, generally spells death. However, it is not uncommon to have an infected blood that stays infected through life and death comes in another form. Malaria or syphilis, both parasitic diseases of the blood stream, are not promptly fatal, although they would prove so unless actively combated with outside agents.

Those of you who are initiated will doubtless query my avoidance of considering the purely chemical aspect of blood, and wonder why, at a time when blood chemistry counts so much, that so little attention has been paid to it in this presentation. My reaction to this query is that consideration of this complicated factor of blood

analysis is much too detailed and technical to afford of its discussion in as elemental a treatise as this. Reference can be made, however, to the fact that the physiologist of today pays far more attention to the chemical qualities and constituents of blood than ever before. Time was when urinalysis comprised the major diagnostic assistance that the laboratory offered the clinician. Albumin or sugar in the urine constituted the greatest contribution along quantitative lines that the chemist had to give to the diagnostician. Today, however, more attention is paid to the analysis of the blood than to the analysis of the urine; and it is a well-established fact that more definite information may be thus obtained.

For instance, is it not far more important for the doctor to know how much sugar is being retained in the blood serum rather than to know how much is being eliminated by the kidneys? For after all it is the noxious substances held inside the kidney threshold that inure to more body hardship than do the noxious substances that are passed out of the body. And so we have today in the laboratory, accurate colorimetric and microcolorimetric tests which tell us just how much sugar there may be in an arbitrary unit of whole blood; or just how much urea, uric acid, creatinin, non-protein nitrogen, dissolved gases, etc. And these tests are so accurate and delicate that the careful diagnostician can by these means gauge his patient's actual blood condition to a nicety.

Likewise in the field of serology much progress has been made. The Wassermann test for syphilis; the Aberhalden tests, the complement fixation tests for Neisserian and tubercular infection, the Widal and other agglutinating reactions are marvellous examples of the trail of success along such lines of blood search and research.

Then again the various methods pursued for determining by culture and otherwise the presence of organisms in the blood stream. How wonderful has been the romance of the development of some of these tests. Not the work of one genius alone, but the correlated and dovetailed results of the painstaking investigations of a hundred plodding workers in this altruistic field of endeavor.

Let me just skim over the reagents used in the conduct of the best known of these tests, namely the Wassermann test. For the manipulation of this one test alone the laboratory worker uses these several reagents:

The red cells from the fresh blood of a sheep.
The serum from the fresh blood of a guinea pig.
The inactivated blood serum of the suspected patient.
An alcoholic extract of the heart of a guinea pig or cow.
An extract of the liver of a syphilitic fœtus.
The blood serum of a white rabbit sensitized to sheep cells.
Human blood serum that is known to be negative.
Human blood serum that is known to be positive.

And to handle these accurately standardized reagents must be granted a patient and a willing and thoroughly conscientious worker, who must at all times realize the need for honest and accurate service.

A brief resume of some of the diseases which infect the blood stream, and some known antagonists might add to the interest of this rather disconnected and garbled paper, but that is possibly a topic that can made the subject of a future lecture.

PLANT PHARMACY.*

By John Uri Lloyd.

May I speak informally on one of the many phases of plant pharmacy? This is an extensive subject, a mighty problem, and I would suggest the consideration of but a restricted thought rather than an attempt to review the field as a whole. Let us begin by means of an argument which by some persons may be considered an excuse or an apology for audacity in what I may afterward express. Turn to your works of authoritative lore, behold, what I have to say may not be found in connection with our subject, nor, perhaps, with any other.

Any opinion contrary to expressed or voiced "authority" is by some people considered heterodoxy, akin to scientific agnosticism. But we are "irregulars." An ostracized people, a minority section in medicine. But by this very fact I hope are liberated from phases

*Informal remarks made at the 1909 meeting of Eclectic Medical Society of the State of New York. Fragment of early lecture delivered in the Eclectic Medical Institute, Cincinnati, 1879, connected with article, "The Ocean of Vitality and Reservoir of Life." This Journal, January, 1922. Permission to publish in a medical journal granted.

of mental bondage forbidden him bound by the code of ethics that restricts mental expansion. We believe we have the right to walk into fields hitherto untrodden, to think, to reason, to expound theories new and strange and proclaim reasons for our opinions, be they what they may. No man can to us say, "I am authority," and by that self-sufficient assertion deny others the right to individual thought. No one, in our opinion, has reached infinity of thought. This privilege I hold as a pharmacist.

The pharmacist of the future, this speaker believes, will stand above our heads, he will see clearly what we have never seen, grasp things we have never touched. Deplorable would it be to reason otherwise. To accomplish this, irregularity of the present must become regularity. And, it *must do so* or pharmacy will either expire of inaction, or be shattered into fragments by the encroachments of invading sciences. Let us, with this audacious assertion in mind, consider some features of the subject, "Plants in Pharmacy."

Comes to thought, as an introduction, what is a plant? And next, what is an animal? What relation exists between the pharmacy of the plant and that of an animal? According to general acceptation, if not the dictionary definition, a plant is a vegetable, "a vitalized structure endowed with life." A living structure, but yet devoid of voluntary motion; devoid of true sense perception may also be applied. To pass further, a scientist might say, plants inhale carbonic acid and exhale oxygen, animals reverse the process.

Let us next consider a typical plant—for example, a tree. There are varieties of trees, ranging from tall trees with mighty trunks to treelike shrubs, in untold number of grades. These may be bushy or slender, drooping like the beech, or tufted like the cocoanut. There are trees with smooth bark, as the birch, and trees whose bark is rough or coarse, as the hemlock, or shaggy, as the hickory. Barks vary to infinity. We cannot define the tree by any one feature involved in descriptions such as these, nor yet by the leaf. For example, the leaves of some trees are single, while the leaves of other trees are compound in tufts; some leaves are smooth, others rough; some leaves exhale one odor, others another, while yet others are odorless.

The tree, be it large or small, is, however, only one form of plant. There are herbaceous plants and woody plants. There are land plants and marine plants. There are even cannibal plants, like

the pitcher plant or the Venus' fly-trap; marvelously do they seem to approach sense perception. The mistletoe, that grows from the bark of the oak or honey locust tree, is typical of vegetable vampires. Many a delicate vine creeps up a tree-support, and finally in ingratitude squeezes the life out of its friendly helper. There are plants that grow in air and have no roots, and others, like the fungi, have no leaves.

Nor, in describing vegetation, can we truly say that a plant has no power of voluntary motion, or yet that it is wholly devoid of a something akin to intelligence. What causes the shrinking, and even the coiling up of some leaves when struck or even touched, as does the leaf of drosera? Habit, may be the reply. Why do some vines twine to the right, others to the left? Why does the clematis, destitute of tendrils, twine its leaf stalk around its support and thus hold itself up? If habit is the answer, one might ask, "What is habit?"

Bring together all the functions of plant and animal, correlate them, and see if you can with satisfaction to yourself draw a clear line separating the animal from the plant. Rather is the link series not like a continuous chain, animals at one end, plants at the other, the lower orders of the two (regardless of micro-organizations) so closely allied in some of their functions as to merge, as does sanity into insanity?

Let us ask, what is plant pharmacy? Superficially it may be defined as the study of plant structures used in medicine, and of the preparations made therefrom. But, although we relegate the term to ourselves, can the apothecary who makes preparations of plants say, "I am *the* pharmacist?" Listen. Undeceive yourself. Every housewife is a pharmacist, every loaf of bread is a pharmaceutical preparation. Do not the pulverized seeds of plants enter into the preparation of bread? Touches not the housewife the science of chemistry as well as of botany? Is not yeast a plant, does not its culture produce chemical changes, liberating from bread-dough both carbonic acid gas and alcohol? Is not the use of sour milk, sodium bicarbonate and cream of tartar in the making of bread a beautiful chemical process? Audacious would be the man, who, because he uses scientific terms and authoritative books, and mixes his ingredients by means of a mortar in a shop or laboratory, claims thereby that he is the only pharmacist. Have we not the home pharmacist? Is not

the kitchen a laboratory of scientific opportunity? Who knows the reactions that ensue in the roasting of beef or the browning of gravy?

Fruits grow and then ripen by means (intrusions) of lower organisms, often linked to animal life, or by inter-reactions akin to decay that breed ethereal flavors. Fruits and seeds are used in home pharmacy, and likewise sugar in the making of preserves, jellies, in canning, etc. In fact, old-time pharmacy, with its cordials, elixirs, sweetened mixtures, paste confections such as confections of roses, fig and senna, pillular or in mass, wedges very closely into home culinary manipulations.

And even closer relationships are bred by systematic observers of foods. Do not our mothers tell us that ripe currants should be sweetened after cooking, because the sugar disappears if they be cooked together; that pie crust should be made and rolled cold with as little manipulation as possible, the lard not being evenly incorporated if the crust is flaky? Good pharmacy is this. They advise that quinces be not *peeled*, in culinary (home) pharmacy, because quince flavor lies in the rind. Is not this true of other fruits, such as the orange, lemon, the apple? Do they not cook damson plums whole in order to get the flavor of the seed, the same rule applying to peaches and cherries? In fact, does not the kitchen very closely parallel the laboratory?

But, one may say, such as this is not pharmacy; these are not pharmaceutical preparations, but foods, nourishers, supportives of life. To this I would reply, where is higher pharmacy than the making of life supportives or of stimulating products to encourage digestion? The pharmacy of death is not my ideal. Consider, what about "beef, wine and iron," so widely advertised as an "exquisite" in pharmacy? What about "beef juice?" What about pepsin? Did not our mothers advise the lining to the gizzard as a digestive food? What about rennet used in our homes in making curd from time immemorial: what substitute have we given in its stead? Has pharmacy improved on the cheeses of the Orient made by means of vegetable curd products, so artfully established that temperature of milk in one night makes sour or sweet curd, as desired? If the milk be warm, next morning the curd or clabber is sour, if cold, it is sweet. [This and some things else I learned in Turkey, the land of cheeses and curds.]

What about the numberless drinks established on the outside that we in "pharmacy" have appropriated? Might we not better, in the face of fact, claim that our laboratory is an ally with our kitchen in the great field in which home pharmacy came first, and in which home pharmacy must be forever a vital problem?

But our text is now plant pharmacy, not the pharmacist, nor yet the motto, "Credit to whom credit is due." Bunch it all together, then ask, Where do plant life and plant pharmacy begin? Where can they end? Is the problem of plant pharmacy (vegetable service) restricted to man? Have we fairly credited vegetation's service in life functions? Have we not seen "through a glass darkly" when we perceive only starches, sugars, fats and nitrogenous flesh as life-giving supportives?

Do you know of any animal that does not depend for its very existence on *vitality* conserved by plant life? Is not the food of all animals derived from plants? Do we not depend on plant life as a mixture, not starch and sugar alone, for our existence? Are we not, therefore, in the life essence taken as a whole, a part of the vegetable kingdom, a transformed, perhaps transplanted part? Should we then, as one of nature's animals, define ourselves as moving plants, because our very life essence is transferred to ourselves from vegetation?

Seek as a second thought to resist the argument that all animals depend on vegetation for life and existence. Think, although the carnivorous animal, like the tiger, lives on flesh, is not his food derived from plant-eating creatures? Is not his vitality as well as substance but one step removed from energy gathered by another creature, his victim, who lives on the grass of the field or the leaves of the forest?

Bones come next in thought because they are generally considered *"inorganic."* But do we not go to plants for materials to form our bones? Can we nourish bone by a diet of stone that contains all the inorganic elements of bone? Do we not chiefly seek wheat and such as wheat to obtain our bone-producing elements, our calcium phosphates, and potassium compounds, all our so-called inorganics? Remember the fate of "Jackson's Bone Food," the compound syrup of the phosphates, introduced by the famous Professor Jackson, of the University of Pennsylvania, to theoretically supply needed earth to deficient bone structure. Theoretically it

was a "bone food," practically it was found to be inadequate. Too much laboratory outside the digestive mystery; nature rebelled. Let us, then, as pharmacists, think of plants as primitive gatherers of materials and vital energies anticipant to animal nourishment. Primitive we say, too often, when we face the inexplainable.

Good business as well as fair ethics is that of give as well as take. The animal lives its life and passes out. The plant comes again into its own; decay means but a transition step, the grass of the field grows over the resting place of the maiden and thrives above that of the philosopher. The cycle begins over again, old ocean and the sun's ray are its ever undying vitalizers.

Comes now another thought: Whether we live on land or sea, are we not all creatures of the ocean? Audacious conception! Let us think. Does not every form of life come from the ocean,* even to the tree growing on the mountain top, so remote from Mother Ocean that one might say, "There is no kinship here?" Does not that tree derive both its food and its vitality from the ocean? Old Ocean rises, falls, throbs, comes and goes endlessly, giving life to all that comes into or passes out of its bosom. Cut off the vapor of the ocean and no rain falls. Suppress that breath, dead is the world.

This breeds another thought, seemingly afar from pharmacy: What vitalizes the ocean, the earth's great reservoir of energy? Whence its power? Look to the sun. Exclaim, in the words of Osseon, "Oh, thou glorious sun!" Its rays uplift the vapor that nourishes all vegetation, its call raises the tides, the moon being secondary influence to that mighty phenomenon, paralyze these currents and the movements of the ocean and the life-giving winds bred therein move no longer over the land. Suppress its vapor and the rain ceases to fall, from shore to shore. The rivers dry, the fertile lands become barren wastes, vegetation withers and perishes, animals die, life disappears. The desert claims her own. Is not the life blood of animals but a touch of Old Ocean's dampness? Is not the life of man, even to the most interior portion of the continents, dependent on the distant ocean's wave?

*See old lecture, "The Ocean of Vitality, The Reservoir of Life." This Journal, January, 1922.

Listen. When Lord Roscoe turned his great telescope on the heavens it is reported that he estimated that 250,000 suns in one hour passed across his field of vision. Today astronomers consider such figures as these but factors in Heaven's Kaleidoscope.

Is not our sun one of the smaller sun-like orbs, our earth one of the smaller space-studding planets? What means this term space? Pass that thought, the conception is too great.

An astronomer hopes to calculate the distance of a star; he turns his instrument on that star and takes its location. On the earth is his telescope ever revolving around the sun. In six months the plant is on the opposite side of the sun. The astronomer is now distant from his former place of observation twice 92,000,000 miles, double the distance of the earth from the sun. Again he turns his telescope upon a very distant star. From the angle of that immense base line he hopes to calculate the distance of the earth from that far-off orb. But the problem is too great. There is no angle. Parallel are the lines. That astronomer needs make his calculations of space depths' treasures from other data. Is this plant pharmacy? Possibly not, but may I not ask who knows the influence of space and its mighty content on earth materials and life? Who knows the influences of unseen, unknown vegetations content on animal life?

Comes now the question: "From what source does the sun derive its power?" Needs we must now stop this line of reasoning. Agnostic enough am I to say, "I cannot comprehend, I know not; I am too feeble, too incapable to attempt to reason beyond life intricacies that nature spins from out the sun's rays." Turn again to Osseon, "Whence comes thy rays, O Sun! thy everlasting light?" Answer who may. May this speaker not add, Where ends the touch of the sun's ray that brings to us consciousness of the little we can grasp in Infinity's book?

Now you ask: "Is such as this plant pharmacy?" Let me answer by asking in turn: "Is not the very essence of plant pharmacy dependent on life's reservoir, maintained from out the energies of space, if plant pharmacy is a study of plant life?" Have not we the right, is it not our duty to consider this mighty subject as a whole as well as in detail? We who live and have our being by the grace of vegetation's service?

THE REFINING OF PALM OIL FOR EDIBLE PURPOSES.

By M. F. Lauro and W. H. Dickhart.*

Palm oil comes from the fruit of certain palm-trees. The chief and practically sole source of supply is the West Coast of Africa, between Gambia and Loanda. The oil is obtained from the outside fleshy portion of the fruit, and is not to be confused with palm-kernel or "P. K." oil from the seed or nut of the same fruit, which is white and resembles cocoanut oil very closely both physically and chemically. There is all the difference in the world between the two oils. Palm oil varies in color from light orange-yellow to a brick—or a dirty dark red, and in consistency from that of soft butter to tallow. The better grades are known as "soft" or low acid oils, such as those from Lagos and Dahomey. The "hard" or high acid content oils are inferior, such as those from the Niger and the Congo districts.

The chief uses are for soap and candle making. It is also employed in the tinplate industry to preserve the iron sheets from oxidation before dipping into the tin bath. This is because the oil is a non-drying and very stable one. It has been used to a slight extent in coloring oils and fats, as in oleomargarine and butter substitutes. In Africa, the natives use for food purposes the oil from the fresh fruit without any further refining than just boiling and skimming.

Because of the crude and primitive methods employed by the natives in its preparation, most of the palm oil that comes to this country is in an impossible condition for other than commercial purposes. As shipped, it may contain from ten to fifteen per cent. free fatty acids, but by the time it arrives here the content of acids has increased to from twenty to over fifty per cent. Considerable water and impurities as sticks, dirt and stones, sometimes intentionally added, are present.

It so happened that we came across a sample of "Bonny Old Calabar" oil, that was unusually clean, of good appearance and of low acid content. We took advantage of the opportunity thus presented, to treat the sample so as to fit the oil for edible use, by first refining with lye as is done here with cottonseed and other

*New York Produce Exchange.

edible oils, then bleaching and deodorizing. The data obtained would be of interest to those who have hitherto thought of palm oil only in a technical way.

It may seem strange that an oil used in soapmaking should be considered for food purposes, but when it is considered that palm oil is a natural fruit-product, and that other oils formerly used only technically have since been converted to food use by refining and eliminating objectionable impurities, there remains no real reason why this rather common oil should not by proper treatment make a good edible oil. So far as we know, there is no physiological objection to its use as such. The question of the palate alone remains.

The fact that operates most strongly against palm oil refining is the poor quality of the oil, due naturally to the lack of care in its preparation on the coast. Were the fruit properly handled, immediately collected and treated to obtain the oil without appreciable fermentation or hydrolysis setting in, circumstances and conditions that appear at present unattainable on account of the climate and native indifference to work, the oil produced would be low in acid and therefore capable of commercial refining. We have found that when the acid content is above fifteen per cent. the loss of oil and the mechanical difficulties involved are too great to permit refining on a wholesale scale. An 18 per cent. acid oil gave us a refining loss of about 50 per cent. On the other hand a 12 per cent. acid oil had a refining loss of less than a quarter of the total oil treated.

Analysis of the crude oil and the refined product:

	Crude	*Refined*
Moisture	2.04%	
Impurities (Dirt, etc.)	1.27%	
Unsaponifiable Fatty Matter	0.64%	
Free Fatty Acids (as oleic)	11.73%	0.10%
Specific Gravity at 99/15.5° C.	0.8556	0.8592
Iodine No. (Wijs)	54.3	53.5
Saponification No.	198.5	196.3
Index of Refraction @ 30° C.	1.4628	1.4627
Titre of the Fatty Acids	45.1	
Iodine No. of the Fatty Acids	52.1	
Neutralization No. of Fatty Acids	200.1	

The crude oil was refined with 13½ per cent. of 18 degree Baumé caustic soda with a loss of 23½ per cent. of the oil. The color and appearance of the refined oil were like the grade known as Red Sherbro. Its taste was sweetish and not unpleasant, but with a distinct palm oil aftertaste. The characteristic odor, that of violets, still persisted.

The soapstock from the refining process was thoroughly mixed and analyzed. Its color was a dirty orange-yellow, and its consistency hard and compact. No free alkali was present. The soap made by purifying the stock was of excellent appearance and grain, quite hard, lathered well and possessed good detergent properties.

Water	27.58%
Total Fatty Matter as Fatty Acids	62.23%
Free Oil	24.95%
Total Alkali as Na_2O	3.10%
Glycerine	2.20%
Impurities	5.30%
Titre of the Fatty Acids	44.8
Iodine No. of the Fatty Acids	52.5
Neutralization No. of the Fatty Acids	199.7

The coloring matter of palm oil is not affected by the lye refining. It may be bleached out by bichromate of potash and muriatic acid, by means of hot air, or by long exposure to light. Heat alone will take the color out. We preferred the last method so as not to introduce foreign substances in the oil. We at first experimented to see how and when the heat caused the color change. At 210° C. the color started to leave and at 255° the color change was definite.

It was, however, not complete, being from a deep orange-red at first, to a light butter-yellow. On the Lovibond scale this read 35 Yellow—6.3 Red, which is within the limit of a Prime Summer Yellow cottonseed oil in so far as color is concerned.

The temperature of the moisture oven was finally adopted for the bleaching process, 105 to 110 degrees Centigrade. The oil, we placed in shallow glass and aluminum dishes for several days at this heat. It was found that aluminum worked more quickly and better, perhaps because the metal acts as a catalyst in this case. The

Lovibond color on the resulting bleached oil was 14 Yellow—1.4 Red, while liquid, a ratio like peanut oil of ten yellow to one red. In fact, it resembles while in a liquid state the color of a white peanut oil, a light green-yellow. As a fat, which it is at ordinary temperature, the color is practically white like cocoanut or palm-kernel oil, except for a slight yellow tint.

Incidentally some of the bleached sample was used to make up a zinc ointment, which compared very favorably with the U. S. P. ointment made with benzoinated lard. The palm oil was slightly harder, and is more stable than lard; hence such an ointment would keep better and not flow as easily as the lard ointment during the summer months.

We now subjected the bleached oil to the deodorizing process, which is chiefly one of injecting live steam into the oil while heated, and thus eliminating the volatile acids that give palm oil its distinctive odor and taste. As we were rather limited in our equipment, we were not able to completely deodorize the sample. However, the flavor of the oil was sweet, with a very slight aftertaste, which was not unpleasant, resembling somewhat the taste of cornmeal.

Analysis of the refined, bleached and deodorized oil:

Specific Gravity @ 99/15.5° C.	0.8596
Iodine No.	53.2
Saponification No.	196.0
Index of Refraction @ 30° C.	1.4634
Melting Point (Capillary method)	40.8° C.
Halphen Test for cottonseed oil	Negative
Villavecchia Test for sesame oil	Negative

The Halphen test at the end of two hours showed a deepening of the yellow color, but the characteristic pink or red of cottonseed oil was not present. In the Villavecchia test, the color produced was a light, pink brown like some Spanish olive oils, and which like them disappears on dilution with water.

The contrast in the deep orange-red of the refined or the crude, and the white of the bleached oils, and the practical elimination of odor and taste, indicate in vivid and concrete manner the possibilities of an extensive use of this rather common oil for edible pur-

poses, taking its place among the fats or the hardened oils used in the manufacture of nut butters, margarine and lard compounds. There are not so many natural vegetable fats available for these purposes. The oils are too soft, and must be either treated by freezing to remove the stearine or converted by hydrogenation to a hardened product. In this climate, palm oil is a fat and a fairly hard fat. Hence, when the conditions of its cultivation and preparation are improved, palm oil should find a ready market as an edible oil.

FOUNDERS' DAY CELEBRATION AT THE PHILADELPHIA COLLEGE OF PHARMACY AND SCIENCE.

Introductory Remarks Delivered by President W. C. Braisted.

To the Members of the College, Our Guests, Ladies and Gentlemen:

We meet again today, the second time in the history of this College, to celebrate "Founders' Day" and to remember and honor the founders of this institution and the group of men who more than one hundred years ago, took the steps that have resulted in the establishment of this great College, with its thousands of graduates, its years of splendid achievement and a wealth of good to humanity, that has made its name known throughout the world and the institution itself the pioneer and for years the leader in all that pertains to pharmacy and its allied sciences.

A year ago the College completed its hundredth year of toil and accomplishment and the first celebration of Founders' Day was inaugurated.

A most interesting history of the origin and growth of this institution was given us by Dean La Wall, together with the history and names of the founders and the little group of men who began the College body. His address is still fresh in your minds, I am sure, and accessible for all time in the records of this institution. It is, therefore, unnecessary for me to review the work that Dean La Wall has so ably and carefully done.

I think, however, that we should always bring to our minds the names of these men—they are:

Samuel Jackson, M. D.
Daniel B. Smith
Robert Milnor
Peter Williamson
Stephen North
Henry Troth
Samuel Biddle
Charles Allen and
Frederick Brown.

It is to be noted that they were mostly young men under thirty and that their lives were actively connected with the business activity of this city. Most all were men who reached more or less prominence in their chosen vocations and were remarkable for courage, industry, integrity and attainment.

With these names we should remember and give reverent thought to the group of the sixty-eight Charter Members of the College body.

If they could have seen the far-reaching benefits and results of their work in the one hundred years of the existence of this Collge, they would have felt well rewarded for the hard work and early struggle for existence.

The splendid results of their efforts stand out before us (the present representatives of this institution) and looking ahead to the next hundred years, should cause us to pause and create a second vision of what *we* can do in the years to come to enhance the value of the rich legacy they have left us. Can we carry on undimmed and unblemished the work entrusted to us? Can we, starting now with the results of the hundred years of their work, produce another century's work that will find us as far ahead of today as their work has advanced during the century passed?

Dear friends, we are at a very critical period of our work. We are looking ahead for the days to come, with high hopes and great ambitions for expansion of our college, for rich returns for our efforts for the good of humanity through this work and looking and hoping for the reward that comes only from successful attainment in adding to the useful store of knowledge that will benefit our fellow-men.

Soon splendid plans for the future will take shape, in fact are taking shape now, that if successfully carried out, will make

our work of the century to come, one of the great outstanding advances in the world's work. Have we the vision to see, the cool heads to successfully plan, and the endurance and ability to bring to successful completion the glorious opportunity before us? With united effort and harmonious and friendly co-operation I believe we can succeed and the coming generations will yield to us the generous mead of acknowledgment of work well done, that we today so gladly give to those who so long ago had the courage and strength to inaugurate the splendid accomplishment we are commemorating this day.

PROFESSIONAL ETHICS.*

By Dr. Judson Daland,

Professor of Medicine, Graduate School of Medicine, University of Pennsylvania.

Mr. President, Ladies and Gentlemen—

It is, indeed, a great pleasure to meet with you this evening, and, in accepting the invitation of your Dean, Dr. LaWall, I fully expressed my appreciation of the honor of joining with you in celebrating the one hundred and first anniversary of Founders' Day.

I also welcomed the invitation because it gave me an opportunity of expressing publicly, what I believe to be the opinion of the medical profession of the United States, that *your* College is to be heartily congratulated upon having secured as its President, Dr. William C. Braisted, whose brilliant achievements during the war, in the discharge of the onerous and difficult duties as Surgeon General of the United States Navy, cannot fail to excite our admiration and enthusiasm. It was my good fortune, as an officer in the United States Navy, to serve under him, and from personal knowledge, I know that he possesses character, judgment, experience and vision, combined with *executive ability* of the highest order, *all* of which will be devoted to *accelerating* the progress of the Philadelphia College of Pharmacy and Science, and under his masterly leadership, *success is assured.*

*Delivered on Founders' Day, at the Philadelphia College of Pharmacy and Science, February 23, 1922.

Pharmacy is a profession and a business, and today is *more* of a profession than *ever* before, and in the future this aspect of pharmacy is sure to steadily increase and, therefore, professional ethics is of *increasing* importance.

Ethics is fundamentally synonymous with right doing, and the various codes that have been established by the pharmaceutical profession are attempts to formulate rules for guidance.

The medical profession formulated the *first* code of ethics, known as the Hippocratic Oath, about 2500 years ago.

Pharmaceutical ethics may be considered from the following standpoints:

1. The pharmacist himself;
2. His relationship to his profession;
3. To the medical profession;
4. To the public;
5. And to the government.

I shall, however, confine myself to the pharmacist as a man and his relationship to the medical profession.

Pharmacists of intelligence, possessing lofty principles and good character, usually act ethically under almost any condition that may rise, and only exceptionally find it necessary to refer to a code of ethics. Fundamentally, therefore, the knowledge imparted to the student by your faculty, coupled with character, promotes ethical conduct.

In medicine, and it is perhaps also true in pharmacy, *no* systematic instruction is given in character building, nor is its importance emphasized, and *no* precise study is made of the character of students presenting themselves for graduation.

For many years I have held the opinion that, even though a student of medicine passes all examinations successfully, he should *not* receive a degree if he did *not* possess *good* character, and I believe this principle is also true for students of pharmacy.

In the last analysis, both in medicine and pharmacy, the proper discharge of the duties of these professions rests upon individual consciousness of right or wrong, and, as most of the work is confidential and performed in private the chief factor in doing right is a properly developed moral consciousness.

In order to develop, increase and maintain a proper ethical spirit, it is necessary that, in addition to receiving a thorough education in pharmacy the student should be instructed as to the importance of a keen sense of right and wrong, truth, justice, right living, right thinking, right doing, moral consciousness and lofty ideals, in a word, *good character.*

Unethical conduct is usually due to ignorance, poverty or avarice. Instructions given by the Faculty of the Philadelphia College of Pharmacy and Science, removes professional ignorance. A student must be taught that, in the beginning years of his work, which is partly of the nature of post graduate instructions, that he must be content with a moderate remuneration, and should not feel the necessity of being unethical in order to secure a greater financial return.

Avarice may be congenital or acquired, is difficult of detection and correction, and *may* be overcome by knowledge and the development of character.

If a pharmacist has acquired character and discretion, he will know what to do when questions arise concerning badly written prescriptions; the necessity of accuracy in compounding prescriptions; that drugs dispensed must fully represent their physiologic activities; the evils of secret formulæ; the impossibility of substituting another drug for the one ordered, or the giving of commissions to physicians.

The splendid work of the *Journal of the American Medical Association* and other institutions and individuals, and the law compelling manufacturers of secret remedies to make known their composition, has *repeatedly* demonstrated the *uselessness* or *harmfulness* of quack remedies that are *only made to be sold at a profit.*

No pharmacist should debase his profession by selling such nostrums.

I realize the financial loss thus incurred, but right conduct frequently necessitates temporary loss, which is compensated for by the personal satisfaction of doing right and by the increase in the confidence of the public as well as that of the medical profession.

Enormous sums of money are lost annually by owners of publications who decline to print advertisements of manufacturers of quack remedies or nostrums, as, for example, daily newspapers like the *Public Ledger* of Philadelphia, or weekly publications like the *Saturday Evening Post,* or the *Journal of the American Medical Association.*

If the owners of such publications are willing to incur so great a financial loss *for purely ethical reasons,* the pharmacist should *likewise* be willing to sacrifice profits arising from the sale of Quack Remedies.

The Philadelphia College of Pharmacy and Science, for more than a century, has always insisted upon the highest ethical ideals, and the members of the present Faculty, following in the footsteps of their distinguished predecessors, desire to still further elevate the profession of pharmacy. I bespeak for them the hearty and enthusiastic support, not only of the alumni and friends of this institution, but all members of the medical and pharmaceutical professions of Philadelphia, Pennsylvania and the United States.

ABSTRACTED AND REPRINTED ARTICLES

PHARMACEUTICAL ETHICS.*†

A Historical Review of the Subject With Examples of Codes Adopted or Suggested at Different Periods, Together With a Suggested Code for Adoption by Present-Day Associations.

By Charles H. Lawall.[1]

Among the earliest of the State associations to formulate and adopt a code of ethics was the Pennsylvania Pharmaceutical Association, which in 1881 adopted the following:

"PENNSYLVANIA PHARMACEUTICAL ASSOCIATION CODE OF ETHICS.

"Preamble. The members of the Pennsylvania Pharmaceutical Association, considering it necessary that some mutual understanding should exist in regard to the moral principles guiding them in their profession, hereby agree upon the following code of ethics:

*Presented before Section on Education and Legislation, A. Ph. A., New Orleans meeting, 1921.

†Reprinted from the *Journal of the American Pharmaceutical Association*, Vol. X, Nos. 11 and 12. November and December, 1921.

[1] Dean of the Philadelphia College of Pharmacy and Science.

"1. We accept the United States Pharmacopoeia as our standard and guide for all official preparations, and recognize a variance from its rules only in exceptional cases, where sufficient authority has proven some other process more reliable to attain the same end.

"This section is not intended to interfere with the dispensing of prescriptions or medicines ordered in accordance with foreign Pharmacopoeias.

"2. Although not a legitimate part of our business, custom and the necessity of the times warrant us in keeping the proprietary medicines of the day; yet, out of regard to the medical profession, and for the protection of the public, we earnestly recommend all pharmacists, when called upon for an opinion of their merits, to discourage their use, and neither to advertise nor permit their names to be used in advertising such medicines.

"3. Recognizing the value of alcohol as a therapeutic agent, and the propriety of its being dispensed as such by pharmacists, yet deploring the wide-spread evil resulting from its indiscriminate use in its hundreds insidious forms, we condemn any attempt to make it a prominent feature of our business as unprofessional; and we denounce the loose practice of allowing it to be used on the premises, in any shape, as a beverage, as degrading, and we urge upon pharmacists the duty of exercising, at all times, a conscientious care in dispensing a drug liable to such dangerous abuse.

"4. We discountenance all secret formulas between physicians and pharmacists, and consider it our duty to communicate such to each other when requested.

"5. We distinctly repudiate the practice of allowing physicians a percentage on their prescriptions as derogatory to both professions.

"6. We will endeavor, as far as it lies in our power, to refrain from compromising the professional reputation of physicians, and we expect the same comity from them.

"7. Since the professional training of the pharmacist does not include those branches which enable the physician to diagnose and treat disease, we should, in all practicable cases, decline to give medical advice, and refer the applicant to a regular physician.

"8. The growing demands of the age require that those who follow the profession of pharmacy should be educated to a higher standard. Therefore, we consider it our duty, individually and collectively, to encourage the advancement of knowledge in our

profession generally, and particularly by stimulating our assistants to attend the lectures of a college of pharmacy, and by aiding and assisting them to do so.

"9. Considering it expedient that some rule should be adopted to enforce the provisions of our code, we hereby agree, if any just cause of complaint of its violation be found against a member of this Association, to bring the case before a special, or the next general meeting of the Association, when the accused, after being heard in his own defense, may be expelled by a vote of two-thirds of all the members present."

This code is more nearly applicable to present-day conditions than any which have been thus far quoted. Section 3 is particularly interesting as showing the attitude of our professional brethren of nearly half a century ago upon the alcohol question.

In 1877 a committee of three physicians and three pharmacists of the City of Antwerp drew up interprofessional rules, which give us a starting point for medico-pharmaceutical ethics:

"RULES OF THE ANTWERP MEDICAL AND PHARMACEUTICAL PROFESSIONS.

"1. Each member of the two branches of the medical corps should abstain from interfering with the prerogatives of the other; the physician should not furnish any medicine to his patients, and the pharmacist should avoid giving medical advice; the pharmacist may, within the limits of the law, furnish medicines which may be asked for, such as a cough mixture, a sedative draught, a purgative, copaiba capsules, etc., without, however, advising that such or another preparation was more suitable.

"2. The physician and pharmacist should conduct themselves toward each other with the sentiments of kindness and confraternity, which unite the members of a family, and should avoid, in the presence of the client, every kind of reflection and unfair remarks; a conciliatory council should be appointed for smoothing such disputes as may arise on the subject of medical practice.

"3. Finally, physicians should, as rarely as possible, prescribe secret remedies and pharmaceutical specialties; on the other hand, pharmacists should abstain from advertising them."

Our own fellow member, the late Henry P. Hynson, formulated a code of ethics for the Maryland Pharmaceutical Association

which was a distinct advance over the former codes in that it takes into account the complex relationships and interdependencies of modern pharmacy.

"HYNSON'S CODE OF ETHICS.

"For the guidance of members of this Association and all pharmacists of the State who may wish to follow the higher practice of their profession:

"Respecting the Pharmacist Himself.

"1. He should, by study, experimentation, investigation and practice, thoroughly qualify himself to fully meet and competently transact the daily requirements of his vocation.

"2. He should possess a good moral character, and should not be addicted to the improper use of narcotic drugs nor the excessive use of alcoholic stimulants.

"3. He should constantly endeavor to enlarge his store of knowledge; he should, as far as possible, read current pharmaceutical literature; he should encourage all such pharmaceutical organizations as seem to be helpful to the profession, and so deport himself as not to detract from the dignity and honor of the calling which this Association, especially, is trying to elevate.

"4. He should accept the standards and requirements of the U. S. Pharmacopœia and the National Formulary for the articles of Materia Medica and the preparations recognized by these publications and, as far as possible, should promote the use of these and discourage the use of proprietaries and nostrums.

"Respecting the Pharmacist's Relations with Those from Whom He Makes Purchases.

"1. He should deal fairly with these; all goods received in error or excess and all undercharges, should be as promptly reported as are shortages and overchanges. Containers not charged for or not included in the charge for contents should be carefully returned, or, if used, should be credited to the party to whom they belong.

"2. He should earnestly strive to follow all trade regulations and rules, promptly meet obligations, closely follow all contracts and agreements and should not encourage or sanction any division of quantity purchases not contemplated in the terms of sale.

"*Respecting the Pharmacist's Relations with His Fellow Pharmacist.*

"1. In this relationship he should, especially, 'do as he would be done by.' He should not make any comment or use of any form of advertisement that will reflect upon the members of the profession, generally or specifically. Nor should he do that which will in any way discredit the standing of other pharmacists in the minds of either physicians or laymen.

"2. He should not obtain, surreptitiously, or use the private formulas of another, nor should he imitate or use another's preparation, labels or special form of advertising.

"3. He should not fill orders or prescriptions which come to him by mistake. Prescription containers with copies and labels of another pharmacist upon them may be filled by him upon request, but he must invariably replace the labels with his own, thereby assuming proper responsibility.

"4. He should never request the copy of a prescription from another pharmacist; the owner of the prescription alone being entitled to a copy, is the proper person to ask for it.

"5. He may borrow merchandise from another pharmacist, provided the practice is reciprocal and equally agreeable to both parties; but the better form is to pay a sum for the desired article equal to the cost and half the profit to be obtained.

"*Respecting the Pharmacist's Relations with Physicians.*

"1. He should positively refuse to prescribe for customers except in cases of urgent emergency.

"2. He should not, under any circumstances, substitute one article for another, or one make of an article for another, in a physician's prescription, without the physician's consent.

"3. He should refuse to refill prescriptions or give copies of them when so instructed by the physician.

"4. He should not place copies of prescriptions upon containers unless ordered to do so by the prescriber, even though the patient should request it. Nor should he use any word or label like 'For external use,' 'Poison,' 'Caution,' etc., without due regard for the wishes of the prescriber, provided the safety of the patient and family is not jeopardized.

"5. Whenever there is a doubt as to the correctness of the physician's prescription or directions, he should invariably confer

with the physician in order to avoid possible mistakes or unpleasantness; changes in prescriptions should not be made without such conference.

"6. He should never discuss physicians' prescriptions with customers, nor disclose to them their composition.

"*Respecting the Pharmacist's Relations with his Patrons.*

"1. He should seek to enlist and merit the confidence of his customers, which, when won, should be jealously guarded and never abused by extortion or misrepresentation.

"2. He should supply products of standard quality only to patrons, excepting when something inferior is specified and paid for by them.

"3. He should charge no more than fair, equitable prices for merchandise, and prescriptions; the time required for the proper preparation of prescriptions should be duly considered and paid for.

"4. He should hold the safety and health of his patrons to be of first consideration; he should make no attempt to treat diseases nor strive to sell nostrums or specifics simply for the sake of profit.

"5. He should consider the reckless or continued sale of drugs to habitues, the illicit sale of abortive medicines or poisons, to be practices unbecoming a gentleman, a pharmacist or a member of this Association."

In this code we see the constructive thought of a high minded pharmacist, who evolved something which is essentially different in both form and scope from those which have been previously quoted. His model seems to have been The Principle of Medical Ethics of the American Medical Association, the present form of which was adopted in 1912, and which, like the foregoing is divided into chapters and sections.

At this time it might be appropriate to quote from the Code of Ethics of the American Medical Association in so far as it pertains to pharmacy.

"*Chapter III. Section 4.*

"*Pharmacists.*

"By legitimate patronage physicians should recognize and promote the profession of pharmacy; but any pharmacist, unless he

be qualified as a physician, who assumes to prescribe for the sick, should be denied such countenance and support.

"Moreover, whenever a druggist or pharmacist dispenses deteriorated or adulterated drugs, or substitutes one remedy for another designated in a prescription, he thereby forfeits all claim to the favorable consideration of the public and physicians."

This is sound and correct as far as it goes, but it leaves something to be desired as to completeness.

Mr. P. A. Mandabach, the late head of the National Association of Drug Clerks, suggested a code of ethics four or five years ago, which is well worth repeating here:

"*Mandabach's Code.*

"The — — —, recognizing that mutual understanding must exist regarding the ethical and moral principles guiding its members in their personal, professional, and commercial activities, hereby adopts the following code of ethics:

"*Section 1.* Members of this Association shall regard themselves as being engaged in a business in which there is a well-defined legal and moral duty and obligation toward public health and life, and shall apply all honorable means in upholding the dignity and honor of the business and profession.

"*Section 2.* The United States Pharmacopœia shall be accepted as the standard and guide for all official preparations, and a variance from its rules be recognized only in exceptional cases where sufficient authority has proved some other process more reliable in attaining the same end. Nothing herein, however, shall interfere with the filling of prescriptions or the selling of medicines ordered in accordance with foreign pharmacopœias, officially recognized textbooks, and formularies.

"*Section 3.* The value of alcohol as a therapeutic agent, and the legal dispensing thereof as such an agent only, is recognized. The sale of alcohol as a beverage and of unlawful abortives or habit-forming drugs shall be considered sufficient grounds for expulsion of the offender from membership in the association. The secretary of the association shall then so report this action to the secretary of the State Board of Pharmacy recommending the revocation of the certificate of registration, as provided for by the State Pharmacy Law.

"*Section 4.* Members shall not be a party to the practice of the commission system or secret formulæ between physicians and pharmacists.

"*Section 5.* Members of this association shall not falsely or maliciously, directly or indirectly, injure the personal or business reputation of a fellow member. Members shall at all times uphold the professional reputation of physicians, in return expecting the same consideration from the medical profession.

"*Section 6.* In view of the fact that the professional training of the pharmacist does not qualify him intelligently to diagnose and treat diseases, members shall decline to give medical advice, and refer the general public seeking such advice to a regular practicing physician.

"*Section 7.* Recognizing the dignity of the profession and believing that those who wish to follow commercial and professional pharmacy successfully must be educated to a higher degree, the association declares itself in favor of prerequisite laws tending to higher standards of pharmaceutical education, and calls upon all members to assist apprentices and assistants in securing adequate collegiate pharmaceutical education.

"*Section 8.* Members shall be governed in the sale and merchandising to the general public of all patent and proprietary remedies and medicines by all State and national laws relating thereto.

"*Section 9.* Members shall expose without fear or favor, all corrupt work, methods, and practices found to exist in the business. They shall bring to the attention of the proper authorities all known violations of State and federal laws as applied to pharmacy, public life and health.

"*Section 10.* In order that the provisions of this code be enforced, each member shall report to the executive board of this association all infractions of this code by any member. If the charges be sustained, after a fair and impartial trial, the accused being heard in his defense, the secretary shall by order of the executive board, expel such person from membership."

The National Association of Retail Druggists have no Code of Ethics as such, but the Preamble and objects as stated in their constitution are practically equivalent as will be seen from the following:

"WHEREAS, the best interests of the people require a high degree of scientific training and professional standing on the part of retail druggists, and

"WHEREAS, it is the duty of our profession to champion all measures which conserve the health of the individual and the community, and

"WHEREAS, the professional and commercial interests of druggists require for their protection united action, we do form a national organization of retail druggists. To effect the purpose of the organization the following Constitution and By-Laws are adopted:

"Article I—Name.

"The name of this organization shall be 'The National Association of Retail Druggists.'

"Article II—Objects.

"The objects of the Association shall be:

"1. To insist upon such training for our professional work as is commensurate with the demands made upon us and is called for by the close relation of our profession to the health and welfare of the community.

"2. To devise ways and means for maintaining a high standard of professional work.

"3. To promote by every means in our power all measures and all legislation honestly intended to prevent the adulteration of foodstuffs and substances used in the preparation of medicines."

The remainder concerns the commercial phases of the organization.

The most recent contribution to the subject which I have seen and the last which I shall quote, comes to us from far across the seven seas. It is take from the *Journal of the American Medical Association*, September 22, 1917, with the accompanying favorable introduction:

"*Medicopharmaceutic Ethics.*

"At a conference held in Melbourne between representatives of the Victoria Branch of the British Medical Association and representatives of the Pharmaceutical Society of Australasia, the Pharmacy Board and Pharmaceutical Defence Ltd., the following rules of practice, among others, were adopted. The rules are so common-sense that they are worthy of consideration in this country.

"1. *Prescriptions—Doubtful Interpretations.*—In cases where there is some doubt regarding the interpretation of any prescription, it shall be the duty of the pharmacist dispensing the same to communicate with the prescriber if possible. It is preferable that such communication should be in writing. In cases where it is necessary to telephone to the prescriber, care should be taken to see that the conversation is as private as possible.

"2. *Correction by Prescriber.*—The prescriber in such a case will recognize that the pharmacist is simply performing what is an important part of his professional duty, and will at once co-operate with him in the interest of his patient. He will correct or confirm the prescription. If a correction is necessary, he may request the pharmacist to retain the prescription, and will forward to him the corrected one. As far as possible, verbal corrections should be confirmed in writing.

"3. *The Attitude of Prescriber and Dispenser* should be one of mutual respect and co-operation.

"4. *Unusual Characteristics.*—In cases where a prescription contains (*a*) an incompatibility, (*b*) an unusually large dose, (*c*) a dangerous dose, or possess some other characteristic of an unusual nature, the prescriber shall indicate that such peculiarity is intended, and is not inadvertent, by underlining that particular part of the prescription, and initialing the same in the margin.

"5. *Where Prescriber Cannot be Consulted.*—Where a pharmacist is doubtful of the interpretation of a prescription, and it is not possible to consult the prescriber, he shall, after careful consideration, modify the prescription in accordance with what he believes to be the intention of the prescriber. He should, if possible, subsequently communicate with the prescriber by letter, and inform him of what he has done. Care should be taken to see that such discretion, when exercised, does not interfere with the therapeutic value of the medicine.

"6. *Modifications to Be Noted.*—Where a pharmacist finds it necessary to modify a prescription, under paragraph 5, he should make a marginal note on the prescription indicating the course he has adopted in dispensing the prescription. The marginal note should be as brief as possible.

"7. *Prescribing by Telephone.*—When prescriptions are dictated by telephone, the following rule should be observed: The prescriber should first write out the prescription, and then read it through the telephone to the dispenser. He should request the dispenser to read to him the prescription as taken down, and should, as soon as possible, forward the original prescription to the pharmacist either by post or by the patient.

"8. *Criticism Deprecated.*—It is undesirable that a prescriber should adversely criticize a pharmacist unless he is guilty of some offense in his calling. The pharmacist on his part should refrain from discussing with the patient the prescriber or the merits of his prescription. Matters relating to professional fees or prices charged for medicines should not be discussed with patients.

"9. *Unsigned Prescriptions.*—When a prescription is received with the 'usual signature,' the pharmacist should ascertain from the patient the name of the prescriber, and, if possible, submit the prescription for his signature before dispensing it so as to relieve the prescriber as well as himself from the risk of penalty. The use of a rubber stamp in lieu of the prescriber's written signature should be avoided.

"10. *Repetition of Prescriptions.*—When it is desired that a prescription should not be repeated, the prescriber should write on the prescription, 'Not to Be Repeated,' or 'To Be Repeated Twice Only,' or any specific number of times. In cases where such directions are given, the pharmacist who dispenses the prescription should indorse the prescription as follows: Supplied (here insert date and pharmacist's signature).

"11. *Spoonfulls—to Be Abandoned.*—With the object of securing greater accuracy in dosage, the use of the words '*teaspoon, dessertspoon,* and *tablespoon*' in the directions on a prescription should be discouraged. Prescribers should write the dosage in drams or ounces, and patients should be advised to measure the doses in a measure-glass."

An interesting contribution to the subject was made in 1910 when the Delegates from the Medical Society of New Jersey to the U. S. Pharmacopœia Convention, presented to that body for consideration the following:

"Ethical Rules for the Guidance of Physicians and Pharmacists in Their Relations with Each Other and with the Public.

"Propositions.—1. Ethical principles or standards of right conduct exist irrespective of their formulation or codification.

"2. Ethical rules are calculated to elevate standards of moral conduct and foster a spirit of harmony between professional men.

"3. A code of ethics is designed not only for the restraint of those who are actuated by unworthy motives, but for the guidance of those, also, who seek to be governed in their actions by high and true principles.

"The Duties of the Physician to the Pharmacist.—1. The physician has no moral right to discriminate in favor of one pharmacist to the detriment of another, except for dishonesty, incompetency or unscientific methods of work.

"2. The physician is never justified in receiving from a pharmacist gratuities in return for patronage; in depositing secret formulas with an individual pharmacist, or by word or deed to jeopardize his professional reputation.

"3. The physician may sometimes find it an advantage to the patient to dispense medicine. Yet, in the main it must be regarded as a subterfuge and a hindrance to all interests involved. The physician should, if practicable, avail himself of the superior technical skill of a trained pharmacist in the preparation and dispensing of medicines.

"4. The pharmacist who recommends drugs or medicines for specific remedial purposes either directly or through the avenues of advertisement thereby exceeds the limits of his profession and commits an act unworthy of his calling.

"5. The pharmacist who consents to diagnose disease or prescribe for patients except where emergencies arise, without a proper medical training, assumes responsibilities for which he is not qualified and justly incurs the disapproval of physicians.

"6. The pharmacist transgresses his true province when for commercial purposes he issues to physicians printed matter setting forth the therapeutic indications for the use of drugs or medicinal preparations. The constituents of a drug or compound together with its chemical and physical properties should be a sufficient guarantee of its utility.

"*The Duties of the Physician and the Pharmacist to the Public.*—7. The combined efforts of the physician and the pharmacist are required to protect the public from the nostrum maker, the pseudo-scientific pharmacist, the sectarian physician and drug vendor, and the two should be in continual alliance to demand the extermination of these commercial and mercenary institutions.

"8. The physician and the pharmacist should, as far as possible, limit the multiplication of manufactured proprietary compounds. It must be regarded as reprehensible to encourage the use of these remedies to the exclusion of those which are official in the pharmacopœias. It is also their plain duty to discourage the use and sale of all medicines which lead to baneful drug habits.

"9. The best interests of the patient are undoubtedly conserved by the custom of physicians to practice rational therapeutics to the exclusion of those methods which tend to the use of many remedies or those of unknown composition; and the supreme effort of the dispensing pharmacist should be to complete the circle of therapeutics by supplying the demands of experimental and chemical teaching with eligible and trustworthy preparations."

This brings some features of present day practice of both pharmacy and medicine into merited prominence.

In the illustrations that have been given, covering all periods and the practice of many countries, we certainly should have sufficient data for the drafting of a modern code of ethics applicable to present day pharmacy in its broadest and most complex sense Many other examples might be quoted from state pharmaceutical associations, etc., but in none of them is there anything essentially new and they are all founded upon one or more of the foregoing examples.

Simplification and conciseness is a desirable quality for which to strive, but beyond a certain point we lose more than we gain when we attempt to condense the material at hand. We must not forget the well known example of Dr. Oliver Wendell Holmes, to illustrate the complexity of a dialogue between John and Henry, in which he convinces his readers that there are six persons taking part in such a conversation, *viz.,* first, John as Henry knows him; second, John as he knows himself; third, John as his Maker knows him; fourth, Henry as John knows him; fifth, Henry as he knows himself; sixth, Henry as his Maker knows him.

The fundamental data can be simplified no further than:

1. The relation of the pharmacist to the public.
2. The relation of the pharmacist to the physician.
3. The relation of the pharmacist to his fellow pharmacist.

In analyzing the codes studied, from this viewpoint, we find that some are top heavy in one direction and entirely lacking in another. It is doubtful if any can be formulated which would not need revision at the end of a decade.

It should be the aim of every pharmaceutical organization to adopt and use as a working guide a code of ethics founded upon sound fundamental principles. This should be freely circulated and kept before the membership by having it printed on each application for membership or upon a separate sheet to be used in connection therewith and it should also be printed in each copy of the Proceedings along with the constitution and by-laws. There are many associations, I know, including our own, where the majority of the members not only have never seen the code of ethics, but would not be able to find it unless they happened to own a complete set of the Proceedings of the organization, and even then only after some difficulty.

A great part of the advance which medicine has made in the past century has been undoubtedly due to the development of a professional class consciousness through the medium of medical ethics, a subject which is instilled into every member of the profession from the time when he first becomes a student, and which he meets at every turn during his active years of practice.

We have much to gain, therefore, in prosecuting diligently the effort to make pharmaceutical ethics mean something vital to the every day welfare and the ultimate advantage of every member of the pharmaceutical profession. With this object in view I hereby suggest the following as a basis for discussion, in the hope that it will result in the prompt adoption of a code of pharmaceutical ethics that will meet the requirements of present day conditions, for our association and any others which care to take advantage of it and adapt it to their particular needs.

PRINCIPLES OF PHARMACEUTICAL ETHICS.

CHAPTER I.

The Duties of the Pharmacist in Connection with his Services to the Public.

Pharmacy has for its primary object the service which it can render to the public in safeguarding the handling, sale, compounding and dispensing of medicinal substances.

The Practice of Pharmacy demands knowledge, skill and integrity on the part of those engaged in it. Pharmacists are required to pass certain educational tests in order to qualify for registration under the laws of most of our states. These various states restrict the practice of Pharmacy to those qualifying according to the regulatory requirements thereby granting to them a special privilege which is denied other citizens.

In return the States expect the Pharmacist to recognize his responsibility to the community and to fulfill his professional obligations honorably and with due regard for the physical well being of society.

The Pharmacist should uphold the accepted standards of the United States Pharmacopœia and the National Formulary for articles which are official in either of these works and should, as far as possible, encourage the use of these official drugs and preparations and discourage the use of proprietaries and nostrums. He should use only pure drugs and chemicals of the best quality obtainable for prescription filling and for sale when the articles are to be used for medicinal purposes.

He should neither buy, sell nor use substandard drugs except for uses which are not in any way connected with medicinal purposes. When a substance is sold for technical use the quality furnished should be governed by the grade required for the stated purpose.

The Pharmacist should be properly remunerated by the public for his knowledge and skill when used in its behalf in compounding prescriptions, and his fee for such professional work should take into account the time consumed as well as the cost of the ingredients.

The Pharmacist should not sell or dispense powerful drugs and poisons indiscriminately to persons not properly qualified to admin-

ister or use them, and should use every proper precaution to safeguard the public from poisons and from all habit forming medicines.

The Pharmacist, being legally entrusted with the dispensing and sale of narcotic drugs and alcoholic liquors, should merit this responsibility by upholding and conforming to the laws and regulations governing the distribution of these substances.

The Pharmacist should seek to enlist and merit the confidence of his patrons and when this confidence is won it should be jealously guarded and never abused by extortion or misrepresentation or in any other manner.

The Pharmacist should consider the knowledge which he gains of their ailments, and the confidences of his patrons regarding these matters, as entrusted to his honor, and he should never divulge such facts unless compelled to do so by law.

The Pharmacist should hold the health and safety of his patrons to be of first consideration; he should make no attempt to prescribe or to treat diseases or strive to sell nostrums or specifics simply for the sake of profit. When an epidemic prevails, the Pharmacist should continue his labors for the alleviation of suffering without regard to risk of his own health and without consideration of emolument.

He should keep his store clean, neat and sanitary in all its departments and should be well supplied with accurate measuring and weighing devices and other suitable apparatus for the proper performance of his professional duties.

It is considered inimical to public welfare for the Pharmacist to have any clandestine arrangement with any physician in which fees are divided or in which secret prescriptions are concerned.

Pharmacists should primarily be good citizens, should uphold and defend the laws of the State and nation. They should inform themselves concerning the laws, particularly those relating to food and drug adulteration and those pertaining to health and sanitation and should always be ready to co-operate with the proper authorities having charge of the enforcement of the laws.

The Pharmacist should be willing to join in any constructive effort to promote the public welfare and he should share his public and private conduct and deeds so as to entitle him to the respect and confidence of the community in which he practices.

CHAPTER II.

The Duties of the Pharmacist in His Relations to the Physician.

The Pharmacist even when urgently requested so to do should always refuse to prescribe or attempt diagnoses. He should, under such circumstances, refer applicants for medical aid to a reputable, legally qualified physician. In cases of extreme emergency as in accidents or sudden illness on the street in which persons are brought to him pending the arrival of a physician such prompt action should be taken to prevent suffering as is dictated by humanitarian impulses and guided by scientific knowledge and common sense.

The Pharmacist should not, under any circumstances, substitute one article for another, or one make of an article for another in a prescription, without the consent of the physician who wrote it. No essential change should be made in a physician's prescription except such as is warranted by correct pharmaceutical procedure, nor any that will interfere with the obvious intent of the prescriber, as regards therapeutic action.

He should follow the Physician's directions explicitly in the manner of refilling prescriptions, copying the formula upon the label or giving a copy of the prescription to the patient. He should not add any extra directions or caution or poison labels without due regard for the wishes of the prescriber, providing the safety of the patient is not jeopardized.

Whenever there is doubt as to the interpretation of the physician's prescription or directions, he should invariably confer with the physician in order to avoid a possible mistake or an unpleasant situation.

He should never discuss the therapeutic effect of a physician's prescription with a patron or disclose details of composition which the physician has withheld, suggesting to the patient that such details can be properly discussed with the prescriber only.

Where an obvious error or omission in a prescription is detected by the Pharmacist, he should protect the interests of his patron and also the reputation of the physician by conferring confidentially upon the subject, using the utmost caution and delicacy in handling such an important matter.

CHAPTER III.

The Duties of Pharmacists to Each Other and to the Profession at Large.

The Pharmacist should strive to perfect and enlarge his professional knowledge. He should contribute his share toward the scientific progress of his profession and encourage and participate in research, investigation and study.

He should associate himself with pharmaceutical organizations whose aims are compatible with this code of ethics and to whose membership he may be eligible. He should contribute his share of time and energy to carrying on the work of these organizations and promoting their welfare. He should keep himself informed upon professional matters by reading current pharmaceutical and medical literature.

He should perform no act, nor should he be a party to any transactions which will bring discredit to his profession or in any way bring criticism upon it, nor should he unwarrantedly criticise a fellow pharmacist or do anything to diminish the trust reposed in the practitioners of pharmacy.

The Pharmacist should expose any corrupt or dishonest conduct of any member of his profession which comes to his certain knowledge, through those accredited processes provided by the civil laws or the rules and regulations of pharmaceutical organizations, and he should aid in driving the unworthy out of the calling.

He should not allow his name to be used in connection with advertisements or correspondence for furthering the sale of nostrums or accept agencies for such.

He should courteously aid a fellow pharmacist who in an emergency needs supplies. Such transactions had better be made in the form of a sale rather than by borrowing, as is often the custom.

He should not aid any person to evade legal requirements regarding time and experience by carelessly or improperly endorsing or approving statements to which he would not be willing to make affidavit.

He should not undersell a fellow pharmacist for the sake of commercial advantage.

He should not imitate the labels of his competitors or take any other unfair advantage of merited professional or commercial suc-

cess. When a bottle or package of a medicine is brought to him to be refilled, he should remove all other labels and place his own thereon unless the patron requests otherwise.

He should not fill orders which come to him by mistake, being originally intended for a competitor.

He should never request a copy of a prescription from another pharmacist. It is the patient's duty to attend to this if he wishes to make a change in pharmacists.

He should deal fairly with manufacturers and wholesale druggists from whom he purchases his supplies; all goods received in error or excess and all undercharges should be as promptly reported as are shortages and overcharges.

He should earnestly strive to follow all trade regulations and rules, promptly meet all obligations and closely adhere to all contracts and agreements.

It is a question to be decided by each association adopting a code of ethics whether to add a penalizing clause, recommending expulsion for violation. It is doubtful whether such action is advisable. The adoption of a code of ethics or rather the complete fulfilment of all its requirements is a matter which requires time to bring about. Certain sections of the Medical Code of Ethics are openly and continuously violated by physicians in communities where conformity to local custom causes deviation. This, however, does not interfere with the fact that medical ethics as a whole are lived up to by the great majority of practicing physicians and constitute a powerful factor in maintaining the high standing of the members of the profession and the esteem in which they are regarded by the public.

When American pharmacists shall have subscribed to such a code as is outlined above it is believed that the medical societies will co-operate in the formulation of a code of medico-pharmaceutical ethics along the lines of the draft quoted from the Australian association, and both professions, as well as the public, will be benefited by the development of an *entente cordiale* which already exists between thousands of individual members of the two professions, but which has never shown itself in the actions of the organized bodies representing medicine and pharmacy.

There are those in pharmacy who misunderstand what is meant by ethics and think it is something visionary and unattainable and

incompatible with business success. To such I would refer the subject for more earnest and thorough study, and particularly would I ask them to read the following quotation from the address of a prominent medical man discussing the subject at one of our meetings some years ago:

"I have no reproach to cast upon trade. Trade is necessary; trade has built up the country, and will continue to build up the country. Trade has given to the physician and the pharmacist the products of distant lands, which the individual could not get and gather it for himself, and trade and pharmacy are often, on the part of the individual, necessarily associated. But I do quarrel—I have an intense and professional and unending quarrel with those who wish to say that pharmacy is only a trade, and a still more bitter quarrel with those who reply to all questions of justice and progress and truth and honor: 'Oh! that is a matter of ethics and this is a matter of business.'

"Now, my father was a man of business, and I take it as a personal insult to his memory when anybody says that business and ethics cannot be carried on hand in hand; that there is anything whatever in trade and commerce which necessarily imposes falsehood and lying and dishonesty upon man. It is not true, and the men who should resent it most are the men of pure business themselves. The profession of pharmacy and the business of pharmacy and the trade of pharmacy can go along altogether upon the most noble principles and upon the strictest ethics; and unless there is a stringent standard of ethics held by all such associations as this and its branches, and unless that standard is strictly enforced upon all its members, upon the manufacturing firms and upon the individual pharmacists and upon the pharmacists' clerks, upon the professors in the colleges and the authors of textbooks, and the students and all—I say, unless this standard is held up and its rules enforced, then pharmacy as a science is doomed to disappear, and the trade of furnishing drugs will fall to the level of the patent medicine business, and I know of no lower one."

Those who have acted in the spirit of ethical practice have been the greatest contributors to pharmaceutical progress. That spirit can be multiplied many fold if a common ideal of professional and trade procedure is adopted.

The foregoing study has been made in the hope of starting a discussion of the subject that will lead to the adoption, by our own and other associations, of some practical, comprehensive code which will have the support of pharmacists everywhere and which will be a vital factor in the association work of the future.

(Concluded.)

MODERN IDEAS RESPECTING ACIDITY AND ALKALINITY.*†

By NORMAN EVERS and J. GAMBLE.

It is recorded that the Romans were in the habit of testing the alkalinity of their drinking water by titrating it with drops of red wine until the coloring matter was no longer bleached. This must be the earliest use of an indicator. It is primitive in its crudeness, employing a substance of varying acidity for judging alkalinity. Although modern standards are more exact than the wine standard used by the Romans, the modern choice of indicators is often no more logical than the Romans' choice of the coloring matter of red wine.

Probably the earliest conception of an acid presented to our youthful minds was that of a substance which effervesces with a carbonate, though the uses of litmus paper were doubtless instilled into us at almost as early a date. As you all know, a carbonate is a very inefficient means of detecting a weak degree of acidity, since CO_2 is not evolved until the solution is saturated with the gas and not until the solution has reached a comparatively high degree of acidity. Litmus remained for many years practically the only indicator of acidity and alkalinity used by chemists, and litmus paper is still employed to a very large extent. It is, however, in many respects a bad indicator compared with the newer synthetic substances, as we shall see later. Phenolphthalein, methyl orange, and other indicators of less importance have been employed for a number of years, but chiefly in titrations, and hardly even as indicators of reaction in the way that litmus paper is employed. The uses of the indicators now employed for the determination of hydrogen ion concentration are an outcome of the developments of the theory of electrolytic dissociation and of the electrometric methods of determining hydrogen ion concentration. Chemists in early days divided solutions crudely into acid, neutral, and alkaline, and it was not until the ionic theory was developed that the subject was given continuity.

*Read before the meeting of the Pharmaceutical Society of Great Britain.
†Reprinted from the *Pharmaceutical Journal and Pharmacist.*

THE IONIC THEORY.

According to the ionic theory, when hydrochloric acid is dissolved in water it is present only to a very small extent in solutions as molecules of HCl, but is dissociated almost completely into ions of hydrogen and chlorine. The hydrogen ions are, according to modern ideas, atoms of hydrogen which have lost an electron, and so become positively charged, while the chlorine ions have gained an electron and become negatively charged. It is unnecessary for our present purpose to discuss the electrical properties of solutions. It is sufficient at the moment to realize that these ions exist in solutions, and that the acid properties of solutions of hydrochloric acid are entirely due to the hydrogen ions which they contain. We may go further than this and state that the acid properties of all solutions whatever are due solely to the hydrogen ions which they contain. Some acids are only dissociated into ions to a very slight extent; their acid properties are, therefore, slight, and they are known as "weak" acids. Hydrochloric acid and other acids which are almost entirely dissociated in solution producing a high concentration of hydrogen ions are known as "strong" acids. The strength of an acid, therefore, depends entirely on the number of hydrogen ions present in a certain volume of its solution—that is, on the hydrogen ion concentration, not on the amount of acid present. It is important to realize that a distinction must be made between the acidity of a liquid and the amount of acid present. The former depends upon the hydrogen ion concentration, the latter is determined by titration. Similarly bases depend for their properties on the presence of hydroxyl (OH) ions, and the strength of a base depends on the number of hydroxyl ions present in its solutions.

Absolutely pure water is itself ionized to a slight extent into hydrogen and hydroxyl ions; obviously the number of hydrogen ions must in this case be equal to the number of hydroxyl ions, there is an excess of neither. Pure water, therefore, is neutral and has neither acid nor alkaline properties, or perhaps it is truer to state that its acid and alkaline properties are evenly balanced.

Pure water contains about a billion hydrogen ions and a billion hydroxyl ions per litre. It is a 10 millionth normal acid and a 10 millionth normal alkali. Our standard of neutrality is pure water in which there is neither an excess of hydrogen ions nor of hydroxyl ions. Solutions which contain an excess of hydrogen ions

over hydroxyl ions are acid, and those which contain an excess of hydroxyl ions over hydrogen ions are alkaline. Note that it follows from this that all acid solutions, even the strongest, contain hydroxyl ions as well as hydrogen ions, but the latter are in excess, similarly all alkaline solutions contain hydrogen ions in number less than the hydroxyl ions. We may take the analogy of a Congressional constituency, which we call a Republican constituency because it returns a Republican member to Congress. But it does not follow that some Democrats are not to be found there, and though they may be a vanishing quantity in certain places yet there is no place so enlightened or benighted (as the case may be) that their number is zero. We might, therefore, speak of the concentration of Democrats in a Republican constituency. Exactly in the same way we can talk of the hydrogen ion concentration of alkaline solutions. In fact, it is usual to refer to the hydrogen ion concentration of all solutions, acid or alkaline, as it involves the use of one factor only, and the hydroxyl ion concentration can always be calculated from the hydrogen ion concentration. It is usual to express the concentration of solutions in terms of a normal solution, a solution which contains in one litre an amount of the substance corresponding to one gram atom of hydrogen (*i. e.*, 1.008 Gm.). Hydrogen ion concentration may be expressed in the same way; a normal concentration would, therefore, be one gram (more strictly 1.008 Gm.) of hydrogen ions per litre.

Consider the following series of concentrations:

Normality.	Hydrogen Ion Concentration [H]	pH	Hydroxyl Ion Concentration [OH]
Normal	$N/1 = N/10^0$	0	$N/10^{14}$
Tenth normal	$N/10 = N/10^1$	1	$N/10^{13}$
Hundredth normal ..	$N/100 = N/10^2$	2	$N/10^{12}$
Thousandth normal..	$N/1000 = N/10^3$	3	$N/10^{11}$
Ten-millionth normal (pure water)	$N/10,000,000 = N/10^7$	7	$N/10^7$
Hundred thousand millionth normal ..	$N/10^{11}$	11	$N/10^3$
Hundred billionth normal	$N/10^{14}$	14	$N/1$

THE VALUE OF pH.

Now the usual method adopted for expressing hydrogen ion concentration is not the rather cumbersome method of normality, but by a value which we know as pH. This value is the power of 10 in the fractions of normality as shown in the above table. Thus we have seen that pure water has a hydrogen ion concentration of one ten-millionth Gm. per litre, or one ten-millionth normal, that is $N/10^7$. The pH of pure water is therefore 7. Similarly, a tenth-normal hydrogen ion concentration, $N/10$, has a pH of 1, and a hundred thousand millionth normal hydrogen ion concentration, $N/10^{11}$, has a pH of 11. Similarly a fiftieth normal hydrogen ion concentration, $N/50$, has a pH of 1.7, $N/50$ being $N/10^{1.7}$.

The points to bear in mind in regard to pH values are: (1) The higher the value of pH the lower is the hydrogen ion concentration, and (2) if the pH is altered by one integer, the hydrogen ion concentration is altered ten times. Solutions having pH values of less than 7 are acid, and those of pH greater than 7 are alkaline. The hydroxyl ion concentration of pOH is obtained by subtracting the pH value from 14.

In much of the work of Pasteur we can trace appreciation of the great influence of the reaction of liquids on enzymes and bacteria. One can see his endeavor to interpret his varying reactions with litmus in relation to an unfixed point of absolute neutrality. As biochemistry developed, the great importance of this factor was clearly seen, and more accurate methods of determination became a necessity. The work of Sorensen at Copenhagen supplied a strong stimulus, and in the realm of physiology the value of his work of elimination and simplification was quickly recognized.

METHOD OF DETERMINING pH.

We pass, then, to the methods of determining hydrogen ion concentration; these are two—the electrometric and the colorimetric. The electrometric method is the more accurate, but it requires expensive and complicated apparatus, and careful attention must be given to detail in order to obtain accurate results. The principle of the method may be outlined. When a piece of metal is dipped into water a small amount of the metal dissolves as metallic ions bearing a positive charge. The metal, therefore, becomes charged negatively with respect to the water. If the solution already contains a

salt of the metal, there is a tendency for the positive metallic ions in solution to separate out on the surface of the metal, causing the metal to become positively charged. The actual difference of electrical potential therefore is the resultant of these two opposing forces, and since the first factor (the solution pressure) is always the same for one and the same metal, the difference of potential due to the second factor is dependent upon the number of metallic ions in the solution. We see, then, that the potential of a metallic electrode in contact with a solution of one of its salts may be used to measure the concentration of metallic ions in the solution. We know that hydrogen behaves in many ways as a metal, and a platinum electrode on the surface of which hydrogen is absorbed behaves as if it were a rod of metallic hydrogen, the solution pressure of platinum itself being practically nil. The difference of potential set up when such an electrode is dipped into an aqueous solution may therefore in a precisely similar manner be used to measure the concentration of hydrogen ions in that solution. The complicated apparatus which is used in this method of determination is therefore employed solely to measure accurately the difference of potential between the hydrogen electrode and the solution, this difference varying with the concentration of hydrogen ions. We pass on to the discussion of the more generally useful method—the colorimetric or indicator method, the data for which are necessarily obtained by comparison with electrometric standards.

An indicator is a substance whose color is affected by the pH of a solution. For example, methyl red has a red color at a pH of 4.4, and in all solutions of greater acidity than this. Above 4.4 the red color gradually changes to a pure yellow at a pH of 6.2, above which no further change occurs. We say, then, that methyl red is an indicator which changes color over a range of pH from 4.4 to 6.2; it will be observed that the change takes place on the acid side of absolute neutrality. Phenolphthalein, with which every one is familiar, changes from colorless to pink from pH 8.3 to 10, that is well on the alkaline side of absolute neutrality. Now if we have a solution whose pH we require to determine which gives a color with methyl red intermediate between these two extremes of red and yellow, we know that its pH lies between 4.4 and 6.2. Further, we can prepare standard solutions of any known pH between these points, and by choosing the standard solution which gives exactly

the same shade of color as our unknown with the same amount of indicator we can thus determine the pH closely.

INDICATORS.

For this method we obviously require a complete series of indicators which change over as wide a range of pH as possible, whose colors are brilliant and contrasting, and show definite changes in shade for a small change of pH. Such a series is shown in the following table:

Indicator.	Color Change.	Range of pH
Thymol blue (acid range)...	Red—yellow	1.2—2.8
Brom-phenol blue	Yellow—blue	2.8—4.6
Methyl red	Red—yellow	4.4—6.0
Brom-cresol purple	Yellow—purple	5.2—6.8
Brom-thymol blue	Yellow—blue	6.0—7.6
Phenol red	Yellow—red	6.8—8.4
Thymol blue (Alkaline range)	Yellow—blue	8.0—9.6
Phenol thymol phthalein	Colorless—pink—violet.	8.3—11
Thymol violet	Yellow—blue—violet ..	9—13

The essentials of a good indicator are:

(1) The color change should be sharp—*i. e.*, the range of pH over which the change occurs should be as short as possible. For hydrogen ion determinations a difference of 0.1 in pH should cause a distinct change of tint in the indicator.

(2) The two end colors of the indicator should form as great a contrast as possible. The change of thymol blue from yellow to blue or brom-cresol purple from yellow to purple is much more easily distinguishable than that of litmus or methyl orange. Unfortunately, the intermediate tints of these indicators with such contrasting colors are not always so satisfactory for pH determinations as those of the yellow-red indicators such as methyl red or phenol red.

(3) The indicator should be affected to the least possible extent by the presence of neutral salts or other compounds.

In all these points the newer indicators, some of which were specially synthesized for the purpose by two American chemists,

Clark and Lubs, have advantages over the old. They cover the complete range from pH 1.0 to pH 13.0.

We are now in a position to examine the defects of litmus as an indicator. (1) The coloring matter of litmus does not consist of a single substance, and its composition depends to a large extent on the method of extraction. (2) Its color change is slow compared with the newer indicators and the colors are not so brilliant. Azo-litmin, which is the chief indicating substance present in litmus, changes color from pH 4.5—8.3, a very much larger range than that of the new indicators. (3) It is affected by the presence of salts and proteins. If a certain mixture of acetic acid and sodium acetate having pH 6.25 be diluted once, eight, or sixteen times, the pH value is practically unaffected, but these solutions will all give different shades of color with litmus solution. These defects are all inherent in litmus itself, but when litmus paper is used other sources of error creep in. (1) The time taken for the paper to reach its correct tint varies very considerably with different solutions and according to the paper used. (2) The material of the paper may itself neutralize the acidity or alkalinity of the solution to be tested, and consequently no change will be observed. (3) Certain liquids, such as milk, urine, solutions of phosphates, have been sometimes described as "amphoteric" to litmus—*i. e.,* they are said to turn blue litmus paper red and red litmus paper blue as though they had some remarkable property of being acid and alkaline at the same time. This is not really the case. These liquids are actually solutions of neutral reaction which bring the color of both red and blue litmus to its neutral tint.

It is possible, therefore, to find solutions of exactly the same PH which give quite different indications with the same litmus paper and again different results with other kinds of litmus paper.

BUFFER ACTION.

If we add one drop of weak hydrochloric acid to pure distilled water we probably change its pH by several integers, say, from 7 to 3. If we add the same amount of acid to water containing a little sodium phosphate the change of pH will be very slight indeed. The phosphate exerts what is known as buffer action —*i. e.*, it tends to resist the change of pH on the addition of acid or alkali. Salts of weak polybasic acids such as phosphates, carbonates,

citrates, or borates exert the strongest buffer action. Proteins or amino acids are also good buffers, whilst all salts of weak acids show the property to some extent. The buffer action of salts of strong acids and bases—*e. g.*, sodium chloride—is very slight indeed. This explains why when one is titrating a strong acid with a strong base to an indicator the end point is very sharp, but with weak acids, and especially with polybasic acids such as phosphates, the end point is gradual and difficult to determine. The reason is that the pH is changing more slowly in the latter cases. Buffer action is of the utmost importance in our bodily functions; all physiological fluids show buffer action. The blood is a splendid example of a buffer solution owing to the sodium bicarbonate, proteins, etc., which it contains. It is of very great importance to our bodies that the blood should be kept within certain narrow limits of pH, and were it not for this buffer action a small introduction of acid into the blood stream would raise its pH to such an extent that the symptoms of acidosis would speedily occur. Fortunately, Nature has arranged that the sodium bicarbonate of the blood must be entirely neutralized before the pH rises to a dangerous point, and this only occurs in very abnormal conditions. We may liken the action of buffer salts which prevent changes of hydrogen ion concentration to a thermostat which prevents changes of temperature.

Returning to the indicator method, we said that the essentials are a complete series of indicators and a series of solutions of any known pH. The first requirement has already been dealt with; solutions of standard pH are prepared from salts which show buffer action. If we tried to make solutions of standard pH by using hydrochloric acid, for instance, or any acid or salt which does not show buffer action, we should find that these solutions were so readily affected by the acidity of the air or the alkalinity of the glass container that their pH would quickly be changed, and they would be useless. By using a buffer salt the solutions are comparatively unaffected by outside influences. Sodium phosphate is a good example of such a salt. The pH of a N/15 solution is 9.2. The pH of a solution of potassium acid phosphate of the same strength is 4.5. By mixing different proportions of these solutions we can obtain a solution of any desired pH between these points. Other salts, such as sodium borate or citrate, may be used to obtain solutions of other ranges of pH. Instead of using a number of in-

dicators, each covering a certain pH range, it is often convenient to use a suitable mixture of indicators covering a much wider range. The "compound indicator" shown, which was devised by Mr. J. L. Lizius, B. Sc., A. I. C., will be seen to show color changes through the spectrum from red to violet over the wide range of pH from 4 to 11. Small tablets containing a definite amount of the compound indicator are extremely useful for the approximate determination of pH. One is dropped into 10 cc. of the solution to be tested, and in about a minute it has dissolved, giving a definite color to the solution. According to the shade of color obtained one can write down at once the approximate pH. We are able, therefore, to determine by a simple test as easily applied as the ordinary test with litmus paper—not only whether a solution is acid or alkaline, but also an approximate measure of the degree of acidity or alkalinity. The value of this to the pharmacist or analyst is obvious. Possibly the approximate pH as given by the compound indicator tablets is all that we require, but if a more accurate determination is desired a single indicator whose pH range corresponds with that given by the approximate determination must be chosen. A definite amount of this indicator is added to 10 cc. of the solution to be tested, and the color observed; knowing the range of the indicator, we can judge approximately from the shade of color what the pH is, and we, therefore, prepare 10 cc. of a solution of this pH from our standard buffer solutions, and add to it the same amount of indicator. If the colors match, the pH is that of the standard; if not, fresh standards of different pH must be prepared until the colors exactly match. An accurate determination of pH can thus be made by a method which is simple and easy to carry out, and requires no complicated apparatus.

If the solution to be tested is itself colored we have to adopt a special device to compensate for the original color. This is known as a comparator. It consists of a block of wood with four holes to hold four test tubes, so arranged that one can look through two pairs of tubes simultaneously. In hole No. 1 is placed the tube containing the unknown solution with the indicator. Behind this, in hole No. 2, is a tube containing distilled water. Hole No. 3 contains the original solution without any indicator, and behind this, in hole No. 4, is a tube containing the solution of standard pH with the indicator. On looking through the two pairs of tubes,

therefore, we get in each case the combined color of the solution and the indicator. The former is thus compensated for, and we can vary the standard solution until a perfect match is obtained. There are some solutions, of course, which are too deep in color for examination by this method, and of these the pH can only be determined by the electrometric method; deeply colored solutions can, however, be treated in this way with surprising frequency. Many colored solutions may be considerably diluted before the determination is made. It might seem at first sight that dilution of a solution would cause a considerable alteration in its pH; while this is so with pure solutions of strong, highly dissociated acids, such as hydrochloric acid, there are many solutions, especially buffer solutions, which may be diluted ten or twenty times with scarcely any appreciable change of pH. In the case of weak acids which are only partially dissociated, dilution causes greater dissociation, with corresponding production of hydrogen ions, and consequently the effect of dilution is diminished. In the presence of a salt of the acid in the solution the effect of dilution is still further reduced. In determining the pH by the indicator method the effect of a moderate amount of dilution can, therefore, in most cases be neglected. For example, a normal solution of asparagine has pH 2.95—after tenfold dilution 2.97, and after a hundredfold dilution 3.11. By now the strict utilitarian in the audience is probably asking: "What is the use of all this? Does it matter whether a solution has pH 6 or 7, whether it has a hydrogen ion concentration of one-millionth or one ten-millionth gram per litre? Is this to come into the new curriculum? Of what practical use is it to pharmacists and chemists?"

PRACTICAL APPLICATIONS.

We shall consider some cases where these differences are important, and try to point to some practical applications. The object of this paper will not, however, be achieved unless it interests some here to the point of seeking their own applications.

The vitality of living cells is dependent upon the maintenance of a strictly limited range of hydrogen ion concentration in their environment, and a difference of pH such as that indicated may have a serious effect upon their growth, or even prevent growth altogether. All living cells or organisms, yeasts, moulds, bacteria, etc., have definite ranges of pH within which growth is possible, and one

definite pH at which growth proceeds at a maximum, just as they have an optimum temperature. For example, *B. coli* grows best at pH 5.0, yeast at 2.5. *B. subtilis* can only grow at pH 4.2 to 9.4.

In order that we may grow these organisms in the laboratory, it is, therefore, important that the medium in which they are cultivated should be at the optimum reaction for their growth. Media for the growth of bacteria, yeasts, etc., are, therefore, adjusted to a definite hydrogen ion concentration suitable to the organism to be grown. In this way it may even be possible by choosing the pH of the medium to encourage the growth of one organism and to discourage others.

The hydrogen ion concentration of physiological fluids is remarkably constant, and, as previously mentioned when referring to the buffer action of blood, these fluids are buffered so as to prevent change of pH. The following are a few examples of the pH of body fluids:

	pH.
Pancreatic juice	8.3
Blood	7.4
Tears	7.2
Human milk	7.1
Saliva	6.9
Cow's milk	6.7
Urine	6.0
Perspiration	4.5
Infant's gastric juice	5.0
Adult gastric juice	0.9—1.6

In the vital processes the hydrogen ions appear not to be directly concerned with the chemical transformations effected, for instance, by the digestive enzymes; they play the part of a conditioning agent like temperature, but their concentration must be within certain limits which differ, for example, in different portions of the digestive tract. Thus, besides an optimum temperature—that of the body—there is for each enzyme an optimum pH as follows:

Enzyme.	Optimum Value of Ph.
Trypsin	8.0
Pepsin	1.4
Invertase	4.5

The optimum pH value agrees approximately with that of the fluids in which their action naturally takes place. Assay work in regard to such enzymes should obviously be conducted under comparative conditions of hydrogen ion concentration, and extraction or purification processes should take this factor into account.

Proteins are able to function both as acids and bases, and are, therefore, known as amphoteric electrolytes or ampholytes. A protein may dissociate into hydrogen ions and negatively charged groups, or into hydroxyl ions and positively charged groups. Taking glycocoll as a simple example of an amino acid, of which proteins are built up, it may be ionized thus:

$$CH_2\begin{matrix} \diagup NH_2 \\ \diagdown COOH \end{matrix} \rightarrow CH_2\begin{matrix} \diagup NH_2 \\ \diagdown COO^- \end{matrix} + H^+$$

$$H_2\begin{matrix} \diagup NH_2 \\ \diagdown COOH \end{matrix} + H_2O \rightarrow CH_2\begin{matrix} \diagup NH_3{+} \\ \diagdown COOH \end{matrix} + OH^-$$

Glycocoll dissolves in sodium hydroxide to form salts, and in this case—that is, in alkaline solutions—the first dissociation is prominent; in acid solutions it acts as a base, the second dissociation being then most marked. Now, obviously there must be a definite value of pH at which these two dissociations are equal, where the compound is acting as an acid to exactly the same extent as it acts as a base. This point is known as the isoelectric point, and each protein or amino acid has its own individual isoelectric point, for example:

	pH at Isoelectric Point.
Histidine	7.2
Casein	4.6
Gelatin	4.6

At the isoelectric point proteins have certain important properties; solubility is at a minimum; if the substance is a colloid it flocks most readily at its isoelectric point; in the case of gelatin swelling is least marked at this point. These facts have a most important bearing on some industrial processes, for example, the preparation of casein, and their application to pharmaceutical preparations which contain albuminous or colloidal material will be at

once seen. A liquid which is practically unfilterable may be made to filter readily if brought to the right pH.

Enzymes, which, as you know, are proteins, also function as ampholytes. If the hydrogen ion concentration is greater than at the isoelectric point the enzyme exists mainly as kations, whereas if the solution be alkaline to this point the enzyme exists mainly as anions. Now, maltose, trypsin, and erepsin are known to be active only as anions, pepsin as kations, and invertase as undissociated molecules.

Curiously, although undissociated pepsin has no action on ordinary proteins, it has the property of curdling milk. In this connection a most important consideration for pharmacists is the stability of some physiologically active principles under different conditions of hydrogen ion concentration. The infundibular portion of pituitary gland contains two active principles, one of which, known as the "pressor" substance, raises the blood-pressure, the other causing contraction of the uterus. Both principles are rapidly destroyed if the solution is allowed to become alkaline. On the other hand the pressor principle in particular is sensitive to too great a concentration of hydrogen ions. In order, therefore, to maintain the original activity of the gland it is of the utmost importance that extraction should be carried out under definite conditions of hydrogen ion concentration.

Solutions of certain alkaloids, such as cocaine and its derivatives, are known to suffer hydrolysis, with consequent loss of activity if allowed to become alkaline, and cases have been known where the alkalinity of the glass used in ampoules has been sufficient to bring this about. Strophanthin also is rapidly rendered physiologically inert by alkali. Such solutions should be buffered.

The disinfectant or preservative action of acids and bases is in large measure due to the hydrogen or hydroxyl ions, and a study of methods of sterilization and pasteurization would probably show that the effective temperature required depends on the hydrogen ion concentration. If a liquid is acid, a lower temperature would be required to effect sterilization than for one less acid. The preservative effect of hydrogen ions is made use of in the preservation of foods by vinegar. All acid beverages depend for their "sharpness" upon the hydrogen ion content, as the following figures show:

	pH Value.
Lime juice	1.7
Lemon juice	2.2
Wines	2.8—3.8
Orange juice	3.1—4.1
Beers	3.9—4.7
Pear juice	4.2
Grape juice	4.5

The effect of pH on the stability of vitamins has not yet been systematically studied, but there is no doubt that vitamin C, the antiscorbutic vitamin, is rapidly destroyed by alkali, and is only stable in acid media.

Milk straight from the cow has a pH of 6.8, *i. e.*, almost neutral; but with the growth of lactic acid-producing bacilli the pH diminishes until at 6.0 it begins to taste sour. At 4.6 (the isoelectric point of casein) coagulation occurs.

Of interest to the botanist or horticulturist is the hydrogen ion concentration of soils, which differ widely in this respect. Just as in the case of bacteria, different species of plants probably have optimum hydrogen ion concentrations at which they grow best. A correlation has been shown to exist between the natural distribution of plants and the pH of the soil, as well as with the growth of harmful or beneficial micro-organisms. Every gardner knows crudely that when a soil becomes too acid it is less productive and must be treated with lime. These applications apply chiefly to life processes or to products from living material. Some instances may be considered where hydrogen ion determinations are of importance in pharmaceutical practice when dealing with chemicals or galenical preparations.

Every pure salt in solution of definite concentration has a definite pH. The salts formed by the combination of strong acids and bases are practically neutral in solution, and have approximately pH 7.0; salts of strong acids with weak bases give solutions of greater hydrogen ion concentration, so that their solutions are acid, while those of weak acids with strong bases are alkaline. If the salt is absolutely pure, therefore, its solutions should have a definite pH. Any deviation from this pH is caused by an excess of either the acid or the base or some other impurity. In this connection the effects of buffer action must be borne in mind. A very slight amount

of impurity would alter considerably the pH of a solution of sodium chloride, but it would require a considerable amount to cause any alteration in a solution of sodium phosphate. By an approximate determination of the pH of a solution of a chemical substance one can very simply decide whether an excess of acid or alkali is present —a method which is far better and less liable to error than the ordinary tests with litmus paper of the Pharmacopœia. Potassium iodide may be taken as an example. Pure potassium iodide, being a combination of a strong acid and a strong base, should be approximately neutral in solution; the B. P. says neutral or slightly alkaline to litmus. The slightest amount of acidity is likely to lead to discoloration of the salt and its solutions owing to liberation of iodine. The presence of a small amount of alkali prevents this—in fact, for pharmaceutical purposes a little alkali is an advantge. If the pH of a 2 per cent. solution is between 6 and 9 the salt may be considered satisfactory, though it should preferably not be less than 7. Of two samples coming within the B. P. tests, one will make a satisfactory mixture with sodium nitrite, another will not. Pure sodium salicylate in 2 per cent. solution should have a pH of about 7.5, but the best commercial samples never give a pH above 6, and usually it is 4.5 or less. The reason of this is that the manufacturers leave a little free salicylic acid in the salt to prevent discoloration.

The quality of calcium glycerophosphate may be judged by the pH of its solutions. The pH of the pure neutral salt in per cent. solution should be about 9.0, and if we find a soluble salt giving a solution of this pH we may be fairly sure that we have a good article. Many commercial samples are much more acid owing to the presence of the acid salt, which helps the solubility but may cover up other deficiencies. This question of the pH of solutions of glycerophosphates is of the utmost importance when they are used for glycerophosphate syrups.

Many other instances could be given of the value of this method in analytical or research laboratories, in the pharmacy or manufacturing laboratory. We may use it for testing the acidity of gelatin, starches, sulphur, and many other products, and for the alkalinity of soap solutions or drinking water. Quite apart from biochemical investigations, where a difference 0.1 pH may be important, the approximate determination of pH by such means as have been in-

dicated is not only a great advance on the use of litmus paper, but provides us with valuable comparative information which litmus cannot give. May we hope that the pharmacists of the future will think of acidity and alkalinity in terms of hydrogen ion concentration instead of in terms of litmus paper, and that even in the B. P. the more scientific method will be recognized? If this should come about it cannot be without advantage to pharmacy.

SUMMARY.

Methods of determining hydrogen ion concentration distinguish between degree of acidity and amount of acid present.

There is a point of optimum hydrogen ion concentration for biochemical processes, the activities of enzymes, the growth of micro-organisms, etc.

In dealing with organized materials the hydrogen ion concentration of the medium is of great importance.

Solutions of pure chemical substances show a definite hydrogen ion concentration which is a valuable indication of purity.

The indicators now available allow pH determinations to be made with considerable speed and accuracy.

In a Pharmacy. . . .

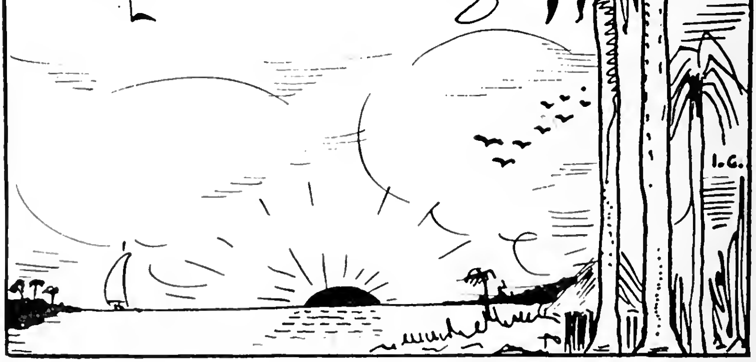
These crowded shelves sweep us in dreams away,
To dim barbaric lands of tropic glare;
Low, steaming jungles steeped in twilight gay,
With flowers lifting in the fetid air.

Far islands deep in blue Pacific seas,
With slow surf creaming on the coral strands;
Backgrounded by the everswaying trees,
With lure and glamour of the lotus lands.

Moors desolate swept by the sullen gales,
Grim mountains rearing to their icy heights;
Far provinces beyond the lonely trails,
And lands lost in the Northern winter nights.

All these contribute to the precious store,
This treasure trove of health that we survey;
Here in the Pharmacy whose open door,
Affords assistance when the days drift gray.

Philadelphia. Thos. J. Murray.



From the Apothecary.

MEDICAL AND PHARMACEUTICAL NOTES

NATURAL VERSUS SYNTHETIC CAMPHOR.—About two years ago efforts were being made to manufacture synthetic camphor, by reason of the embargo that the Japanese Government had placed on the natural product. Monsieur André Dubosc has recently outlined in a very instructive way the mad and victorious struggle in which the Japanese trust became engaged with the European manufacturers. Synthetic camphor proved to be of such a quality as to constitute a dangerous competitor of the products of the distilleries of Formosa. Its use in celluloid, especially, gave perfect results. This being the case, the Japanese trust tried at first to enter into negotiations with the manufacturers of the artificial product, offering to buy, at good prices, their total output, which would have been sold under the Japanese mark. These offers were not accepted, our manufacturers hoping to become the masters of the market. The Japanese trust then began to lower its price so as to undersell synthetic camphor. It commenced to bleed white the forests of Formosa, thus doubling and tripling production. At the same time, through purchases made by its agents in Bordeaux, it succeeded in raising the price of turpentine, which is the base for synthetic camphor. The price of turpentine rose more than 100 per cent., which proved ruinous to our manufacturers. By lowering finally the price of 1 kg. (2.2 pounds) of camphor to 3 francs, with no limitations as to quantity, which price included freight charges to all European and American ports, the Japanese trust succeeded in giving the *coup de grâce* (finishing stroke) to the manufacture of synthetic camphor. The factories closed, having gone into bankruptcy. Their equipment was sold and scattered to the four winds. After allowing sufficient time to elapse; that is, when it appeared that there was no possibility of the manufacturers of synthetic camphor getting on their feet again, the Japanese trust raised its prices to 110 and even 120 francs per kilogram. The present price is around 25 francs.

The world's consumption of camphor, in 1914, was approximately 18 million pounds (8,181,818 kg.), and since the regeneration of camphor forests is slow, it will be seen that there is still a place for synthetic camphor.—(*Journ Amer. Med. Assoc.*)

Whitfield's Ointment.—Whitfield's ointment is composed of benzoic acid and salicylic acid incorporated in a petrolatum base. According to Sutton (*Diseases of the Skin*, Edition 4, p. 1018) it consists of:

	Gm.	
Salicylic acid	1	gr. xv
Benzoic acid	2	gr. xxx
Petrolatum	30	℥ i

Goodman (Epidermophytosis Pedum et Manuum, *Arch. Dermat. & Syph.* 3:652 [May] 1921) gives this formula for Whitfield's ointment:

	Gm. or Cc.	
Salicylic acid	1	gr. xv
Benzoic acid	1 6	gr. xxv
Petrolatum	8	ʒ ii
Cocoanut oil	30	℥ i

—(*Journ. Amer. Med. Assoc.*)

Effect of Opium on the Stomach.—Opium alkaloids usually increase the acidity of the stomach. Even in cases of extreme hypoacidity, normal acidity in the stomach is brought about with opium. It is shown that there is a distinct difference between hypoacidity and anacidity, for in the presence of anacidity opium does not produce a normal acidity. While opium alkaloids usually raise the acidity, they retard the motility of the stomach. The evacuation time of the stomach is primarily lengthened, independently of the acid conditions. The alkaloids close the pylorus even though there is an anacid condition of the stomach, for the retarded motility associated with increased tonus and active peristalsis cannot be explained in any other way.—L. Jarno and D. Marko (*Wiener Klin. Wochenschr.*, Vienna, October 13, 1921, through *Journ. Amer. Med. Assoc.*, January 14, 1922, 156.)

The Treatment of Carbon Monoxide Poisoning.—Carbon monoxide poisoning is one of the most widely distributed and most frequent of industrial accidents, says the U. S. Public Health Service. The gas is without color, odor or taste. It is an ever-present danger about blast and coke furnaces and foundries. It may be found in a building having a leaky furnace or chimney or a gas stove without flue connection, such as a tenement, tailor shop, or boarding house. The exhaust gases of gasoline automobiles contain from 4 to 12 per cent. of carbon monoxide, and in closed garages men are not infrequently found dead beside a running motor. A similar danger may arise from gasoline engines in launches. The gas is formed also in stoke-rooms, in gun turrets on battleships, in petroleum refineries, and in the Leblanc soda process in cement and brick plants. In underground work it may appear as the result of shot firing, mine explosions, or mine fires, or in tunnels from automobile exhausts or from coal or oil burning locomotives.

Carbon monoxide exerts its extremely dangerous action on the body by displacing oxygen from its combination with hemoglobin, the coloring matter of the blood which normally absorbs oxygen from the air in the lungs and delivers it to the different tissues of the body.

Oxygen will replace carbon monoxide in combination with hemoglobin whenever the proportion of oxygen in the lungs is overwhelmingly greater. Therefore:

1. Administer oxygen as quickly as possible, and in as pure form as is obtainable, preferably from a cylinder of oxygen through an inhaler mask.

2. Remove patient from atmosphere containing carbon monoxide.

3. If breathing is feeble, at once start artificial respiration by the prone posture method.

4. Keep the victim flat, quiet and warm.

5. Afterwards give plenty of rest.

Laboratory Workers Contract Tularæmia.—All six of the laboratory workers of the U. S. Public Health Service, who have been studying tularæmia, a disabling sickness of man which has been known, particularly in Utah, for the last five years, have con-

tracted the disease, two of them being infected in the laboratory in Utah and the other four in the Hygienic Laboratory in Washington. Such a record of morbidity among investigators of a disease is probably unique in the history of experimental medicine.

Two of these workers are physicians; one is a highly trained scientist; and the others are experienced laboratory assistants. One of them contracted the disease twice, once in the laboratory in Utah and again, two years and five months later, in the laboratory in Washington.

In these workers the disease began with a high fever, lasting about three weeks, and was followed by two months of convalescence. The disease has few fatalities, its chief interest arising from the long period of illness which it causes in midsummer, when the farmers of Utah are busily engaged in cutting alfalfa and plowing sugar beets.

The studies into the cause and transmission of the disease show it to be due to a germ, *Bacterium tularense,* which is conveyed by six different insects: the blood-sucking fly, *Chrysops distalis;* the stable fly, *Stomyox calcitrans;* the bedbug, *Cimex lectularius;* the squirred flea, *Ceratophyllus acutus;* the rabbit louse, *Hæmodipsus ventricosus;* and the mouse louse, *Polyplax serratus.* Only the first four of these are known to bite man. It appears possible that the germ may also enter through unbroken skin; for instance, that of the hands.

SCIENTIFIC AND TECHNICAL ABSTRACTS

Increased Trade in Camphor.—During the past five years exports of camphor from China have shown a steady increase. Whereas, camphor exports in 1919 amounted to 316,933 pounds, valued at $150,489, the Chinese exports of this article in 1919 amounted to 3,079,066 pounds, worth 2,168,030, and further increased to 3,999,600 pounds, valued at $3,493,252, in 1920. In regard to the camphor trade of China, the Chinese Maritime Customs Returns says:

Formosa has a virtual monopoly of the world's camphor supplies, although the quantities arriving from that quarter are gradually diminishing. The principal producing districts in China are the Kiangsi, Fukien, and Kwangsi Provinces, but the crude system of Chinese distillation cannot yet compete with the up-to-date methods employed in Formosa, while the Chinese practice of cutting down the trees without planting new ones will soon kill this industry unless reforestation is attended to. Prices for camphor and camphor oil have greatly increased in recent years, and, as the future of the trade looks hopeful, there should be sufficient inducement to take the necessary steps for the encouragement of this valuable industry.

FORMALDEHYDE IN URINE.—Dr. E. Pittarelli proposes the following test for formaldehyde in urine: To 25 to 30 mils of the urine (acidulated, if not already acid) add 10 to 12 drops of a 1 per cent. solution of phenylhydrazine and heat the mixture to boiling. After a few minutes add 5 to 6 drops of 1 per cent. solution of monomethyl-paramidiphenol sulphate (photol) and 3 to 4 drops of a 25 per cent. solution of caustic soda when a crimson coloration develops; on now adding a magnesium salt a decided purple coloration develops. The crimson color is still visible in a 1:100000 solution of formaldehyde, while the purple color is observable in even still weaker solutions.—(*Merck's Report.*)

BLOOD TEST IN DIABETES MELLITUS.—Williamson describes a test for blood sugar. Twenty cmm. blood are mixed with 1 cc. of a 1:6,000 aqueous solution of methylene blue and 40 cmm. liquor potassæ. The mixture has a deep, definite blue or bluish green color. The tube containing the mixture is placed in a water bath, and the water kept boiling for four minutes. If the blood sugar is decidedly increased, the blue color of the mixture will change to brownish yellow (almost the color of normal urine). When the blood sugar is not increased the mixture tube retains its blue or bluish green color. —(*Journ. Amer. Med. Assoc.*)

Estimation of Acetone.—The accuracy of the iodoform method for estimating acetone in aqueous solution depends on the amount of potassium hydroxide added. With either an excess or a deficiency of the hydroxide quantitative results are not obtainable even after standing. If the volume of the aqueous acetone is 20 cc., 10-15 cc. of 3 N/2 potassium hydroxide must be taken, and the reaction is then complete in two minutes. For 100 cc. of acetone solution, 25 to 30 cc. of the hydroxide must be added, and the time of reaction is three to five minutes. In two experiments with absolute acetone in aqueous solution, the results obtained were correct within 0.1 and 0.5 per cent. respectively.—Hermans (*Chem. Weekblad*, 1921, 18, 348, through *J. S. C. I.*, 1921, p. 488).

Determination of Sugar in Urine.—In the method devised by Benedict and Osterberg the urine is diluted so that the specific gravity does not exceed 1.030. Fifteen cc. is treated with about 1 gm. bone-black (smaller quantities of both may be used if desired). The mixture is shaken vigorously occasionally for from five to ten minutes, and then filtered through a small dry filter into a dry flask or beaker. From 1 to 2 cc. of the urine filtrate is measured into a test tube which is graduated at 25 cc., and if the volume used was less than 3 cc. enough water is added to make the volume exactly 3 cc. Then exactly 1 cc. of 0.6 per cent. picric acid solution (best prepared from dry picric acid) and 0.5 cc. of 5 per cent. sodium hydroxid solution are added. Just before the tube is ready to be placed in boiling water 5 drops of 50 per cent. acetone (this should be prepared fresh every day or two by diluting some pure acetone with an equal volume of water) is added taking care that the drops fall into the solution and not on the sides of the tube. The tube is shaken gently to mix the contents, and placed immediately in boiling water for from twelve to fifteen minutes. The standard solution is simultaneously prepared by treating 3 cc. of pure glucose solution (containing 1 mg. of the sugar) exactly as described for the unknown solution and heating simultaneously. The pure glucose solution containing 1 mg., of the sugar in 3 cc. of solution will keep indefinitely if preserved with a little toluene. The authors have not been able to find a colored solution which matches the colored product of the reaction and which is permanent.—(*Journ. Biol. Chem.*, through *Journ. Amer. Med Assoc.*)

Synthetic Gasoline.—A German process for making gasoline, called the Burgess process, has been developed by the originators of the Haber process for the fixation of atmospheric nitrogen by combining it with hydrogen. In carrying out this process hydrogen is passed over carbon at 200 atmospheres pressure and at a temperature of 700° C., whereby hydrocarbons are formed. It is stated that the process has been examined by an American engineer, who has reported that the method is in actual operation and is producing motor fuel on a small scale. If this process should succeed in competing with gasoline from petroleum it would be of great industrial importance. From *Journ. Indus. Eng. Chem.* 14, 165, through *Amer. Jour. of Science.*—(H. L. W.)

Thymol, Menthol and Menthone From Eucalyptus Oils.—The genus *Eucalyptus* includes numerous species, Australasian in origin, some of which are among the tallest trees in the world. Their leaves contain volatile oils of complex composition. In many species a crystallizable phenol is present, but it is not thymol. A study of the oil from *E. dives*, known locally as the "broad-leaved peppermint," has been made by Smith and Penfold, of the Technological Museum of Sydney, N. S. W., the results of which appear in *Jour. Roy. Soc. N. S. W.*, for 1920 (vol. 41).

That the leaves of certain species of Eucalyptus have an odor resembling peppermint was noticed by the early settlers. Baker and Smith first isolated the constituent to which the odor is due and found it to be a ketone. They called it "piperitone." From the *E. dives,* the yield is, at some seasons, over 3 per cent. As this species is one of the most abundant of the genus a rich source of the ketone is available. The remainder of the oil is mostly phellandrene, which is now recognized as one of the most serviceable materials for flotation work and has other uses.

Thymol can be obtained from piperitone by comparatively simple operations, and menthone is also easily obtained by reduction, from which menthol can be produced by further reduction. Piperitone is normally levorotatory, as is also the corresponding alcohol, piperitol, but readily passes into a racemic form if heated to its boiling point under certain conditions. The piperitone originally obtained was inactive because it had been distilled under atmospheric

pressure, but when distilled under very low pressure the tendency to racemation is overcome. Piperitone combines with sodium acid sulphite without much difficulty, but the compound is soluble in the aqueous solution, but on standing several days a crystalline mass separates from which the pure substance can be recovered.

The authors of the paper describe the production of thymol, menthone and menthol from pure piperitone. The yield of thymol was 25 per cent. of the original material, but it is believed that improvements are possible by which the amount required by theory can be produced. The thymol obtained responded to the standard tests for that substance. To obtain menthone, piperitone was subjected for six hours, at a temperature ranging from 175° to 180° C., to the action of purified hydrogen in presence of a nickel catalyst. The double bond was readily opened out with formation of menthone, but the carbonyl group was not affected even after two days' action. Under correct conditions, however, the reduction to menthol will take place. Sodium amalgam or sodium cannot be satisfactorily applied in these procedures, because a solid bi-molecular ketone is promptly produced. The yield of menthone by the process above noted was almost theoretical, and it responded to the tests for that substance. Any unchanged piperitone can be removed by the action of sodium sulphite.

Menthol was obtained by heating the reduction product from piperitone at from 170° to 180° C. for two hours with an equal weight of phthalic anhydride, dissolving the melt in sodium hydroxide, and removing the small quantity of menthone by ether. The phthalic acid compound was regenerated by treatment with dilute hydrochloric acid, the phthalic ester decomposed by boiling with alcoholic potassium hydroxide, and the menthol separated and crystallized. The odor was excellent, but the product was optically inactive, as is usual with synthetically prepared substances. A separation of the two components is, however, possible.—(H. L.)

SOLID EXTRACTS

About twenty kinds of flies frequent houses. Practically all of them are potential carriers of disease.

It is believed that shellfish and fish are responsible for the bulk of London typhoid fever during the past twenty-five years.

"If a few rows of squashes are planted in cucumber and cantaloupe fields, the moths that lay the pickle-worm eggs will attack the squashes and not the other fruits." But the horticulturist must beware of a cross-fertilization, particularly inasmuch as the squash is very fond of mating with the cantaloupe.

Alterations in ancient Greek manuscripts were so common and so easily made that Democrates composed his book of medicaments in metrical form so that there might be no change made in numbers or words. A translation made with a desperate sprinkling of poetic license follows:

Master, Master,
Use a plaster,
Powdered rice and alabaster.
Turpentine and oil of wine,
Gin and oil of castor.

Twice the usual mileage could be obtained if a tellurium compound were added to the gasoline and motors were charged to higher compression.

Recent research seemingly shows conclusively that endemic goiter is due to deficient supply of iodin in drinking water.

Vitamines have recently been found to stimulate the growth of certain molds. Other molds are either able to do without them or else are able to manufacture them for themselves.

Lead may be too pure for practical purposes. Roofing made of commercial lead, 99.9 per cent. pure, is too soft and when on a steep roof has a tendency to flow downward under its own weight and the heat of the sun.

The Mulford exploration party, now in South America, has secured photographs in Bolivia of what is considered to be the largest tree cactus in the world. It has a limb spread of forty feet or more.

From twenty to twenty-five gallons of 95 per cent. alcohol can be obtained from a ton of dry coniferous wood, such as Douglas fir or Southern yellow pine.

"Electron" is not only a name for the divisions of the atom but also for an alloy consisting of 95 per cent. magnesium, 4½ per cent. zinc and ½ per cent. copper.

A patient was admitted into a Philadelphia hospital recently who had almost exhausted himself with hiccoughing over a period of five days. He was permanently cured by being partially anæsthetized with ether, administered in the usual way.

The white cell of the blood is endowed with hypnotic powers over certain parasites. It is said that the Hæmogregarina Stepanovi becomes paralyzed when it comes in contact with a leukocyte. Its wavy motion stops and it places itself in a stiff position, mesmerized into inactivity. It is then promptly gobbled up by the white cell. This parasite infests reptile blood.

What is the color of pure elemental iron?
Brown? No!
Rusty yellow? No!
Guess again!! No, sir! its color is a silver white!!!

The only way to disarm a poisonous snake is to kill it. Removing the fangs only affords an opportunity for others to grow quickly into their place. In fact a number of small half-grown fangs are always waiting, ready to be developed.

NEWS ITEMS AND PERSONAL NOTES

Professor Cook, with Mr. Cliffe, a member of the Board of Trustees, attended the conference of representatives of pharmaceutical bodies, which recently met at Washington to discuss the alcohol question.

The tenth lecture of the popular series was delivered by Ivor Griffith, on the subject, "One Drop of Blood." A large audience, constituted in part of hospital technicians and internes, attested to the value and interest of this type of instruction. Dean LaWall is next on the program with his "Foods of the Next Century" lecture, which is certain to be of interest, particularly to those who "can eat in any language."

The Alpha Sigma, Chemistry Organization, is proud of its scientific record. It does not satisfy itself with Smokers and Dances, but prefers to hold meetings which afford some mental nourishment. Each month alumni members address the society on some technical chemical topic and the meetings are well attended.

Adley B. Nichols, Instructor in Operative Pharmacy, recently attended the Grand Council meeting of the Phi Delta Chi Fraternity in session at Kansas City, Mo. Mr. Nichols takes an active interest in the affairs of this body, which may account for the strength of this College's chapter of that famous fraternity.

The Freshman class gave a Reception and Dance to the Senior class at the LuLu Temple, evening of February 20th. As usual the Freshmen were on hand in gay numbers, but the Seniors were not quite so plentiful. They do say that Professor Youngken was giving his examination the next day. And of course that "is another story."

Founders' Day Celebration, which occurred February 23, 1922, bids fair to be an annual occurrence. A varied program, which consisted in part of speeches by a number of prominent educators and physicians, entertained quite a large gathering of Philadelphia pharmacists and others interested in the College. Dean Bradley, of the Massachusetts College of Pharmacy, was one of the speakers of the evening.

President Braisted was the principal guest of the Kiwanis Club at one of its recent functions; and the brilliant address which he made on this occasion made a deep impression upon his audience. He spoke of the plans for the new and enlarged college, and the visions which he had for making it a centre of pharmaceutic and medical research.

The monthly meetings of the faculty continue with regularity. The Engineers' Club is the accustomed meeting place, and after the dinner, usually well selected and prepared, comes the menu of mental calories. At the March meeting following a well-chosen dinner of pasteurized potatoes and par-boiled spinach, Dr. Horn, professor of physical chemistry, spoke exhaustively on the subject of Vitamines. It was one of the keen, analytical and systematic presentations, which Dr. Horn knows how well to deliver.

The annual dance of the Phi Delta Chi Fraternity was held Thursday evening, March 16, at the Belmont Country Club. It proved to be the biggest social function of the College year.

The American Pharmaceutical Association has available a sum amounting to $360 which will be expended after October 1, 1922, for the encouragement of research.

Investigators desiring financial aid in their work will communicate before June 1st, with Prof. H. V. Arny, Chairman A. Ph. A. Research Committee, 115 West 68th Street, New York, giving their past record and outlining the particular line of work for which the aid is desired.

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EDITORIAL

THE REGENERATION OF A GREAT PROFESSION.

Imagine two young people, living in an isolated district where the opportunities for education or self-betterment are very limited, have fallen in love with each other. The young man sees in the girl the exempification of all the virtues of his community; he can see no lack in her education, incomplete as it is, nor does he find fault with her manners, crude though they may be, because he knows nothing better himself. Moved with ambition to improve his condition he goes out into a larger community. An opportunity is grasped to go to college. After four or five years he returns to his native town. The girl who before had seemed to him the paragon of all the graces now appears untutored and awkward; virtuous as she may be she no longer holds any attraction for him.

Analogous to these two lovers is the situation of pharmacy and medicine. A few years ago the druggist and the doctor were on a practical parity as far as education, or rather lack of education, was concerned. Twenty-five years ago any one of ordinary ability with a grammar school education, after three years of study in a medical school, was ready to go out to practice medicine. Educational qualifications of the man who wrote the prescription at that time were practically equivalent to that of the man who compounded the prescription, for the extra year of schooling that the physician received was compensated by the practical experience in the drug store required of the pharmacist. Today the physician must not only be a high school graduate, but also have had one or more years of collegiate education, must have spent four years in the medical school and, in some States, a year of hospital experience before he can be legally licensed to practice his profession. During

the past three decades while the physician has increased by seven years the time of preparation for his life work, the pharmacist has added but two. Is it any wonder that the doctor of today shows a tendency to hold the apothecary in lower esteem than did his father when both professions were equally lacking in their educational qualifications?

The whole community today is more highly educated than it was a generation ago. Illiteracy has practically disappeared, our high schools are taxed to their capacity, and even the colleges are embarrassed in their attempts to find a means of caring for those who are eager for more knowledge. Is it to be marvelled at, that the druggist no longer holds the respect and deference of the community that were his a few years ago?

Many are viewing with alarm today the manifest tendency towards the commercialism of the drug-store. They foresee the degeneration of a dignified profession to a petty business. As a business retail pharmacy can never take high rank, the class of goods that it has for sale are financially piddling; as a profession an exalted position is open, the class of service it has to offer is of paramount dignity.

The history of pharmacy is a noble one. The contributions of the pharmaceutical profession towards the improvement of our therapeutic agents, up until the middle of the last century, were as notable as those made by the medical profession. The names of Scheele, of Sertürner, and of Pelletier stand as high in the scroll of medical fame as any physicians of their day. But the part played by pharmacists of recent years in the epochal developments of Materia Medica has not been nearly so conspicuous.

The reasons that pharmacy in recent years has contributed so little to the advance of medicine, I believe, may all in their last analysis be referred to the insufficiency of pharmaceutical education. In the first place, the investigator who is lacking in thoroughness of training is at a disadvantage which only the most positive genius could struggle against. But more important than even this handicap is the fact that a pharmaceutical career holds little attraction for men of scholarly ambitions. "Birds of a feather flock together"; a young man eager to accomplish something in the scientific world naturally gravitates towards that profession where something is being accomplished.

It seems to me undeniable that pharmacy has fallen from her erstwhile high estate. How is she to regain the respect of the medical world? Certainly not by boasting of past glories or whining over present indignities, but only by "bringing forth fruits meet for repentance." First and foremost, we must cease from holding our profession so cheaply. The world will not respect us until we respect ourselves. Pharmacists must demonstrate their own belief in the dignity of pharmacy by opening her gates only to those who are deserving; in other words there must be an elevation of educational standards and the degree in pharmacy made to stand for something in the intellectual world. To do this it is essential that the schools of pharmacy shall no longer be bound down by financial anxieties. Higher education today is not and cannot be self-supporting. Any institution which looks to the fees of its students as the sole source of revenue unfits itself to compete with "institutions of learning." The temptation, nay the necessity, of lowering the bars to admit all those who have the money to pay, however lacking in mental qualifications, is too strong to be resisted. Either a considerable endowment or the continuing contributions of philanthropic citizens to meet a considerable part of the expense of the college of pharmacy is an absolute *sine qua non*.

Granted this readjustment of our educational requirements, little by little pharmacy will again elevate its position; the higher type and better preparation of the rising generation of pharmacists will gradually make themselves felt in the intellectual world. But the process will evidently be a slow, evolutionary one. Much can be done to hasten the consummation by what we might call artificial stimulation of research. There are still many men in pharmacy qualified by native ability and educational training to make valuable contributions to the good of humanity. Many of these, however, are held down by the routine drudgery of teaching, which they must do to earn their bread and butter, and by the absence of the incentive of a sympathetic atmosphere. I can imagine no more hopeful means of arousing the latent scientific ambitions of pharmacists than the extraordinary vision of President Braisted. His plan of a great institution of therapeutic research offers at once both the opportunity to do something worth while and the stimulation which comes from contact with those who are doing.

It behooves the pharmaceutical profession of the country—not merely the Alumni of the Philadelphia College of Pharmacy, but all those interested in the welfare of their calling—to acclaim their interest and lend their active support to this, the most hopeful, nay the only promising, constructive plan for the regeneration of a great profession.

H. C. W., Jr.

HOSPITAL PHARMACY.

The other day there came to a certain Philadelphia hospital a man of authority whose business it was to make a careful statistical report of the hospital's facilities and personnel. He inquired with great care into the equipment of the institution, making painstaking entries onto a huge ledger page which he had with him. Very little seemed to escape his trained eye. He had made a business of his work and his entries into the record sheet showed that thoroughness was one of his strong points. Operating room service, anæsthetic procedures, ward arrangement, kitchen and diet room equipment, social service department, free clinic features, surgical dispensary equipment, office force, financial and hospital records,—everything passed in parade before his careful scrutiny. The laboratory equipment, number of microscopes, colorimeters, autoclaves, incubators, microtomes and what not, laboratory records and personnel were given detailed consideration, but oddly enough out of his hundreds of questions not a single one was directed towards the hospital pharmacy. We wondered how such a thorough investigator could ever have neglected this important part of the hospital organization, and we sought from him an explanation of this peculiar omission. And strangely enough, he could give no intelligent answer other than to state that the Commissioner, whose agent he was, had never inquired into hospital pharmacy conditions and that he had apparently deemed the matter of insufficient import to merit inquiry and consideration.

This ignoring of a department so fundamentally necessary to the proper conduct of a hospital seems to us very unwise and not at all in keeping with modern ideas of service. It may be true to some extent that therapeutic nihilism is the order of the day,

but internists and surgeons alike still depend upon therapeutic agents to perform specific duties and to relieve their patients of discomfort or pain. The surgeon's or the internist's responsibility, insofar as the therapeutic agents are concerned, ends with annotating upon the patient's chart the medicament desired.

But who is to superintend the furtherance of the remedy? Who is to see that the proper dose of the correct and standardized drug is furnished to the patient? The surgeon orders his patient an intravenous injection of bicarbonate of soda or irrigation of a wound with Dakin Solution—and he expects that his patient's welfare is impeccably cared for by having these solutions properly prepared. There is much at stake. It may spell life or it may spell death for the patient. To whom does the hospital look for the exact manipulation of these agents? Is the man who prepares these vital remedies equipped for his work? Oddly enough this most important phase of medical service is greatly overlooked and disregarded, and particularly so by the organizations which prescribe specifications for hospital management and service.

Would not a tentative list of questions such as we are submitting here aid in diagnosing the value of the hospital pharmacy service and also help in elevating the standards of the profession in that important phase of its activities?

QUESTIONNAIRE.

A. *Outline of Pharmacy Staff, With Particular Reference to the Following Data:*

Is the chief pharmacist a college graduate, and a registered pharmacist in the resident State?

Are the assistants State qualified?

What are the hours of service in the pharmacy?

What laboratory assistance can the pharmacy furnish? (Very frequently the pharmacist is well equipped to assist in important laboratory service for he may be a trained chemist or bacteriologist.)

Who has direct charge of the narcotic supplies and are the narcotic records carefully kept?

Who has direct charge of the alcohol and alcoholic liquid supplies and are these records carefully kept?

Who is the purchasing agent for the pharmacy supplies? Are they economically and carefully purchased? Is quality or cheapness the basis of purchase? (Unfortunately the condition exists where an intimate knowledge of drug valuation is not possessed by the buyer, frequently the superintendent or medical director.)

Is the pharmacy self-supporting?

B. *Specific Questions:*

Do you manufacture your own tablets, ointments, pastes, galenicals, ampules, etc.?

Are you equipped to standardize, by assay or otherwise, your fluidextracts and tinctures?

Have you a system whereby antiquated and therefore inert preparations are regularly discarded?

Do you manufacture and standardize your own Dakin's Solution?

Are you equipped to prepare the various intravenous medications, 606, neoarsphenamine, etc.?

Are the biological supplies properly refrigerated?

Have you an assembled collection of poison antidotes ready for emergencies?

It is understood that this list is but tentative and open to a good deal of correction. But it is a step in the right direction and hospital pharmacy should not be conducted in the haphazard way which we know is the *modus operandi* of that important department in many of the small institutions, where engagement of a trained pharmacist is deemed unnecessary.

I. G.

The importance of food to human welfare is paramount, water and air being the only other factors which affect one hundred per cent. of the population one hundred per cent. of the time. J. Russell Smith says in his introduction to "The World's Food Resources":

"Did you ever figure out just what you would do if your food supply failed? You probably have not, but a good observer who has seen men in all stages of starvation in the Yukon wilderness, has it worked out in this way: 'If a man misses his meals one day, he will lie. If he misses his meals two days, he will steal. If he misses his meals three days, he will kill.'"

Statistical figures of food consumption by countries show wide variations. The inhabitants of the United States are the greatest consumers of food in the world today, with a record of 2664 pounds of food per year per capita. The Japanese hold the low record with 980 pounds of food per year per capita.

FOODS OF THE REMOTE PAST.

During the half million or more years that man or a semi-simian ancestor is known to have inhabited the earth, he has left certain records which have been fairly continuous and more or less certain only during the past five or six thousand years. From the time of *Pithecanthropus Erectus,* passing through the periods of *Homo Heidelbergensis, Eoanthropus, Homo Neanderthalensis,* the *Cro-Magnards,* and the *Grimaldi,* down to the *Neolithic man* of ten or twelve thousand years ago, each succeeding race must have consumed food.

In Wells' "Outline of History" the author quotes Mr. Worthington Smith upon this subject as follows: "Primeval man is commonly described as a hunter of the great hairy mammoth, of the bear and the lion, but it is in the highest degree improbable that the human savage ever hunted animals much larger than the hare, the rabbit and the rat. Man was probably the hunted rather than the hunter. The primeval savage was both herbivorous and carnivorous. He had for food hazel nuts, beech nuts, sweet chestnuts, earth nuts and acorns. He had crab apples, wild pears, wild cherries, wild gooseberries, bullaces, sorbs, sloes, blackberries, yewberries, hips and haws, water cress, fungi, the larger and softer leaf buds, nostoc (the vegetable substance called 'fallen stars' by country folk), the fleshy, asparagus-like rhizomes or subterrannean stems of the Labiatæ and like plants, as well as other delicacies of the vegetable kingdom.

periments have been made with a variety of P. radula (*Perfumery and Essential Oil Record,* V, 1914, p. 423); but they have not been continued.

According to a notice of Bertoni (in the *Coltivatore* ex. *Bull. Off. Gouv. gén. de l'Algérie;* cf. Schimmel, Ber., 1907, I, p. 45), the cultivation of pelargonium in Italy is inconsiderable in spite of the rising consumption in the tobacco industry and its importance for the manufacture of perfumes. I must confess that nothing is known to me about the cultivation of pelargonium in Italy or of its use in the manufacture of tobacco.

CULTIVATION.

The plant may attain an age of more than twelve years (Charabot and Gatin, p. 290). In cultivation, all plantations are renewed after from five to six years (Heuzé, p. 307). The plant is indifferent to great heat, but suffers if the temperature sinks to 2° or 3° C., so that a winter temperature of 5° C. may be considered the lowest limit of cultivation. Réunion and Algeria, whose average winter temperature is from 11° to 12° C., are therefore much more favorable to the cultivation of the plant than Southern France, where the plants must be renewed every year or else be protected from the cold. To grow exuberantly, the plant needs a quantity of rain of at least 700 mm., and a locality well exposed to the sun. Good artificial irrigation, as it exists in Réunion, increases the weight of the crop, but not the quantity of oil in tons. In France and Algeria, therefore, this method is not used, especially because the soil is soon exhausted and gets a firm crust, which at length does harm to the plant.

QUALITY AND CULTIVATION OF THE SOIL.

The rose-pelargonium prefers a soil which is well permeable and of silicious or silicious-clayish quality. As the plant is very sensitive to stagnant water, the soil must be perfectly level and deeply plowed, the plant being in need of good ventilation to grow well. By this method also the root-stocks of Cynodon dactylon, the most disagreeable weed of Northern Africa, are removed. After every cutting the rows are hewed through or slightly plowed. The quantity of manure and the manner of its application and distribution is of great importance. Concerning this we have some accounts.

Boutilly on Réunion (p. 179), for the conditions prevailing there, recommends an annual manuring of a ton of superphosphate

per hectare. He tries (see table below) to prove that lime is worthless (cf. columns 5-6 of the table) and chloride of potassium and nitrate of natrium prejudicial (columns 7-9) to the plant. De Villèle (pp. 218-219, 249-251), on the other hand, maintains that lime is an excellent manure for acid soils such as are frequently found in Réunion.

Kind of Manure, (According to Boutilly, p. 178)		Results of an are. 1st ctg. Jan., 1895.	2d ctg. May-June, 1895.	3d ctg. Nov., 1895.	4th ctg. Mar., 1896.	Total.
1. Superphosphate,	200 kg.	1.085	1.335	1.4	.51	4.33
2. Superphosphate, Nitrate of sodium, Lime,	100 kg. 50 kg. 50 kg.	1.065	1.405	1.3	.525	4.295
3. Superphosphate, Chloride of potassium,	150 kg. 50 kg.	1.18	1.165	.925	.54	3.81
4. Superphosphate, Chloride of potassium, Nitrate of sodium, Lime,	60 kg. 50 kg. 20 kg. 70 kg.	.765	.995	.88	.49	3.13
5. Lime,	200 kg.	.690	.99	.8	.485	2.965
6. Without manure,		.795	.635	1.	.31	2.74
7. Chloride of potassium,	200 kg.	.32	.67	.89	.44	2.32
8. Chloride of potassium, Nitrate of sodium,	150 kg. 50 kg.	.49	.8	.61	.325	2.225
9. Nitrate of sodium,	200 kg.	.615	.515	.855	.24	2.225

He sees a confirmation of his opinion in analysis. The good effect of superphosphate is due, in his opinion, less to the phosphate itself than to the sulphate of lime, which is mixed with it.

Belle, whose plantations are situated in France at Biot, Dépt. des Alpes Maritimes, recommends 800 kg. of superphosphate, 600 kg. of nitrate of sodium, and 400 kg. of chloride of potassium per hectare (Charabot and Gatin, p. 291).

Lecq and Rivière recommend 300 kg. of sulphate of ammonium, and 150 kg. of sulphate of potassium (Charabot and Gatin, p. 291).

Jolivet uses 300 kg. of superphosphate, 200 kg. of nitrate of sodium or, in place of the latter, 150 kg. of sulphate of ammonium, and 150 kg. of potassium (Charabot and Gatin, p. 291).

PROPAGATION.

The propagation is made by cuttings, as the plant is mostly sterile. I have found, however, wild specimens producing fruits in the outskirts of the town of Alger, near Maison Carrée. For the propagation the third cut is generally used, the autumn drivings,

"He had birds' eggs, young birds, and the honey and honeycomb of wild bees. He had newts and snails and frogs. He had fish and fresh water mussels. By the seaside he would have fish, molluscs and seaweed. He would have many of the larger birds and smaller mammals which he could easily secure by throwing stones and sticks or by setting simple snares. He would have the snake, the slow worm and the crayfish. He would have various grubs and insects, the larger larvæ of beetles and many caterpillars. A chief and nourishing object of food would doubtless be bones smashed up into a stiff and gritty paste. A fact of great importance is this—primeval man would not be particular about having his flesh food over fresh. He would constantly find it in a dead state, and, if semi-putrid, he would relish it none the less, for the taste for 'high' or half putrid game still survives."

Speculation again, you say? Not altogether, for evidences of the use of some of these foods have been found in the debris of caves, or of the long-submerged habitations of the lake dwellers or of the kitchen middens of paleolithic or neolithic man.

FOODS OF BIBLICAL TIMES.

An interesting source of information regarding foods is found in the Bible whose chronology covers nearly six thousand years and carries us to a point slightly beyond the dawn of the Christian era.

The foods mentioned throughout the Bible are the earliest to be recorded in literature by civilized man. The first mention of food in the book is in Genesis I, 29: "And God said, Behold I have given you every herb bearing seed which is upon the face of all the earth, and every tree in the which is the fruit of a tree yielding seed; to you it shall be for meat."

That man's existence in the Garden of Eden was to have been as a vegetarian, as indicated by the foregoing, is confirmed by the next reference to food in Genesis II, 16, 17: "Of every tree of the garden thou may'st freely eat, but of the tree of the knowledge of good and evil, thou shalt not eat of it."

No reference to flesh foods is directly made until some time after the expulsion from the garden, although one wonders what became of the flesh of the animals from which were taken the skins used for clothing (Gen. III, 21).

The first direct reference to the slaughter of animals is in connection with Abel's offering (Gen. IV, 4).

The next reference to food is in Genesis VI, 21, and is also a general reference, naming no specific food: "And take thou unto thee of all food that is eaten, and thou shalt gather it to thee and it shall be for food for thee and for them."

It is hardly possible that no flesh foods were eaten at this period for Abel had already been described as a "keeper of sheep," and it is hardly likely that he kept them for ornamental purposes. It is not until after the flood, however, that express permission is given to consume flesh food, in Genesis IX, 3: "Every moving thing that liveth shall be meat for you; even as the green herb have I given you all things. But flesh with the life thereof, which is the blood thereof shall ye not eat."

It is curious that prior to the mention of any specific food in the Bible, excepting the apple, reference is made to wine in the incident of Noah and the product of the vineyard.

The first mention of foods by name begins in Genesis XIV, 18, where "Melchizedek, King of Salem, brought forth bread and wine for Abram." The first mention of flesh food is a little later on when Abraham "fetched a calf, tender and good." In connection with this same meal are mentioned fine meal, cakes, butter and milk.

Other foods mentioned in Genesis, in the order of their appearance are lentils, the meat of young goats, venison, corn (used in the generic sense to denote grain), wheat, mandrakes, oil (undoubtedly olive oil), grapes, bake meats, honey, nuts, almonds and spices.

Additional foods mentioned elsewhere throughout the Bible are barley, beans, citron, cucumber, figs, fishes, garlic, hazel nuts, herbs, husks, leeks, locusts, melons, millet, mulberries, nuts, olives, onions, pomegranates, quails and rye.

The corn of the Bible was either millet, wheat, or spelt (rye), never maize, which was not then known in the eastern hemisphere. The apple was probably the apricot. The husks were St. John's bread. Nuts were walnuts or pistache nuts. Herbs included lettuce, endive, chicory and mint. Spices were anise, cassia, cinnamon, coriander, cumin, dill, hyssop, mustard, rue and saffron.

Eating and drinking were looked upon as important functions and our expressions regarding "the fat of the land" and "the good things of Egypt" are of Biblical origin.

The early peoples of all lands were great consumers of the edible game which abounded in the forests and of the fish which inhabited the streams. Among many early races and continuing up even to medieval times, there was a common soup pot or family dish, in which the whole meal appeared. This is undoubtedly the origin of the term "pot luck," still prevalent with us.

China had possessed for thousands of years a flourishing agriculture and horticulture at the beginning of the Christian era, but we are just beginning to realize the possibilities of that country through the work of the Bureau of Plant Industry of the U. S. Department of Agriculture, of which more will be said later.

Their records show that over 2000 years ago one of their ambassador explorers brought back from western Asia the bean, the lucern, the saffron, the sesame, the walnut, pea, spinach and the watermelon, all of which had hitherto been unknown to the Chinese. China, in return, gave to the world the peach and the apricot, both of which are sometimes erroneously credited to Persia, and also a number of the citrus fruits.

The early civilizations of the American continent had carried agriculture to a high degree of perfection and the contributions of the new world to the list of news foods are second to none in importance, as will be seen later.

FOODS OF LATER PERIODS.

Feasts and banquets in past ages seemed to have called forth more food varieties than do similar events today, for we hear of larks' tongues, of pheasants drenched with ambergris and of pies of carps' tongues. During the period of the Renaissance the banquet came to be more luxurious and expensive than ever. There were often principal dishes called "subtleties" in the nature of a surprise, such as a cooked pelican sitting on the nest with its young, or a whole peacock in full panoply, the skin and tail being replaced after the fowl was cooked. In 1466, upon the occasion of the enthronement of Archbishop Neville, it is said that at the banquet which followed there were 104 peacocks served in this manner.

Whale meat was often found on royal tables in the fifteenth century. Porpoises and grampuses were served whole.

Meats of this period in Great Britain included fowl, pork, beef, mutton and veal.

The fish of this period are enumerated and described with great particularity by Izaak Walton.

Beer or wine was an indispensable part of the English menu in the eighteenth century. Oysters and wine were considered the proper thing for breakfast.

Sweets and conserves, including sugar, were first used in the Orient and spread through Italy to the remainder of Europe. They were first sold exclusively by the apothecaries, who also had complete control of the retailing of spices.

The culinary art or the cooking of foods is a complete subject in itself, which has its own literature and its separate historians. In feudal times and until later, the large households required quantities which would stagger the housewife of today. From one of the cook books called a "Booke of Simples," which dates from the early part of the eighteenth century, are quoted the following:

A cake calling for a quarter peck of flour.

A beverage (metheglin) made from twelve quarts of honey and twelve gallons of water.

A rump of beef, baked.

A bread baking, starting with a peck of flour.

A barrel of oysters made into an oyster stew.

A milk punch made from 5 quarts of brandy, 8 quarts of water, 2 quarts of milk, 4 dozen lemons, 3 nutmegs and 1½ pounds of sugar.

New foods undoubtedly were making their appearance during this period. In a cooks' and confectioners' dictionary (1723) by John Nott, asparagus and spinach are mentioned for the first time in the culinary literature, although both had been cultivated for centuries in some localities.

The discovery of America brought a number of important new foods, some of which took several centuries to introduce, but which now form important staple foods for millions of people. The more important of these are the potato, sweet potato, maize, tomato and chocolate. Explorers and colonizers from time immemorial have been responsible for the introduction and cultivation of new foods.

The most comprehensive survey of the origin of foods was undoubtedly that of De Candolle, who in his classic work on "The Origin of Cultivated Plants" (1882) names the following vegetable foods which have been cultivated for more than 2000 years, and also gives the country of their origin.

Asia.—Radish, garlic, onion, taro, yam, garden cress, tea, sugar cane, grape fruit, lemon, orange, tangarine, grape, mango, plum apricot, peach, quince, pomegranate, cucumber, olive, egg plant, banana, bean, pea, soy, pistache, buckwheat, barley, millet, rice, sesame, black pepper, coconut.

Europe.—Horseradish, turnip, carrot, cabbage, asparagus, pear, apple, lentil, spelt (rye), oats, walnut.

Africa.—Watermelon, date, sorghum, coffee.

Mediterranean Basin.—Beet, celery, lettuce, leek, grape, cherry, almond, fig, chestnut, mustard.

America.—Jerusalem artichoke, potato, sweet potato, manioc (tapioca), arrowroot, maté, vanilla, guava, pumpkin, squash, prickly pear, persimmon, capsicum, tomato, avocado, paw-paw, pineapple, chocolate, maize, quinoa, peanut, lima bean.

In the list of vegetable foods which he states are of comparatively recent origin as regards cultivation are parsnip, salsify, spinach, parsley, artichoke (flower heads), chicory, endive, okra, raspberry, strawberry, gooseberry, currant, muskmelon.

From this survey it will be seen that our great variety of the present, as compared with the past, is due to improved methods of cultivation and transportation. J. Russell Smith says: "The Great War with its starvation made nations see, really see, what a century of world trade had done for them by giving them the whole world from which to feed themselves. In the matter of food supply there has been far more change since the days of George Washington than there was in all the time between George Washington and Caesar, or Nebuchadnezzar, or Cheops, who built the pyramids of Egypt."

"In 1786 a Massachusetts farmer wrote a pamphlet telling just how he supported his family. With the wheat and corn and buckwheat that grew in his fields he furnished the family bread. The chickens, pigs, sheep and occasional beef that he slaughtered fur-

nished the meat. His garden furnished all the vegetables and his orchards all the fruits, many of which, along with garden vegetables, were dried for winter use. Thus the farm produced the family food. For clothing his wife spun the wool which he sheared from the sheep; and the flax that grew in a corner of the field was made into linen. The skin of the meat animals was tanned and made into shoes and thus they were clothed. The trees from his wood lot furnished the boards to build his house and the logs for his fire and the rails for such fences as were not made of stone. He himself, like most farmers of that time, was a fairly good worker in wood and had a little blacksmith shop, so that he made practically all of his own tools on rainy days and in snowy winter weather. Only a few things were needed from the outside world, such as salt, pepper, a little lead and gunpowder, and iron for his little forge. These outside products cost him altogether $10 a year, permitting him to save $150 out of the $160 received for the wheat and cattle that he sold."

Newspaper advertisements of a hundred years ago throw additional and interesting light upon conditions existing then. Among the auction and market offerings in a Philadelphia daily newspaper of 1822 are mentioned the following foods: St. Domingo coffee, mackerel, Spanish chocolate, salt pork, sweet oil, New Orleans, Havana, Batavia and Muscovado sugars, nutmegs, mace, cinnamon, lemons, pecan nuts, flour, rice, barley, oats, beans, peas, almonds, cheese, starch, raisins, hams, dried peaches, onions, codfish, shad, honey, molasses and tea. These, it will be seen, are staples, and no perishable foods are mentioned in any of the advertisements of that period, which I have been able to find.

In a paper of the same period an advertisement of a then prominent restaurant promised its patrons that mush and milk would be served upon certain evenings.

There were few or no manufactured foods at that period. Food canning, which began during Napoleon's reign, through the invention of this process of Nicholas Appert, had not established itself as a commercial possibility.

During the past seventy-five years more changes have occurred in food habits, food preparation, food distribution and food selling, than had taken place in many previous centuries. The first great epoch was that in which occurred the development of manufactured

and package foods. During the early part of this period there was much indifference to the welfare of the consumer shown by the manufacturer. Adulterations were common and exaggeration of value was prevalent. Working upon the old principle of *caveat emptor,* the attitude of the manufacturer was selfish to an extreme degree. The passage of State and finally of national food laws, coupled with the scientific investigations of many individuals and organizations, has brought about great improvement in this direction. The results of study and experiment upon calorific values, protein ratios, the necessity of certain mineral constituents, the indispensability of certain food accessories or food hormones, known as vitamines, is now common knowledge to the well-informed individual.

It is a strange but true fact that with all of our improvements in the distribution of foods and the wider range that is offered for selection, some of our most important staples, such as wheat, flour, cane sugar, etc., have been so debased by the removal of certain valuable elements in order to satisfy the inexplicable demand for whiteness, that the individual who eats freely of them must supply the lacking elements by the use of other foods in which they are contained, or must suffer in consequence. The failure of our Government to properly protect the health of its citizens by prohibiting the unnecessary sulphuring of dried fruits, is another of the discouraging features of the present with regard to foods.

IMPROVED TRANSPORTATION METHODS OF THE RECENT PAST.

The great triumph of the recent past has been in so improving methods of transportation that products from far distant lands can be brought to metropolitan markets in a condition approaching perfection of quality. This has resulted in diminishing the seasonal scarcity of many perishable fruits and vegetables and also tends to equalize prices throughout the year.

Shell eggs have been successfully transported from China to the eastern part of the United States under conditions so perfect that they are almost equal to nearby fresh eggs. Soft fruits, such as peaches and plums, are shipped from South Africa during the winter months and appear in the windows of the fancy fruit stores frequently, in New York and Philadelphia. Melons, grapes, cherries, peaches and pears have also appeared during the past winter from Chile, Argentina and other South American countries. The South

American fruits have not been as well packed as the South African fruits, and do not reach our markets in as good condition as do the latter, although the South American fruit reaches us in fifteen days while the South African fruits require over a month. By another winter, when the South American shippers have learned to pack their products properly, it is likely that practically all fresh fruits will be obtainable every month in the year for those who can afford or are willing to pay the price.

Strawberries are now obtainable in any large city practically throughout the whole year, from our own country. In illustration as to what transportation has accomplished and in sharp contrast to the experience of the Massachusetts farmer previously referred to, J. Russell Smith says: "The man of today starts his breakfast with an orange from California or Florida, or a banana from Central America, or an apple from Oregon, Virginia or New York. He takes a shredded wheat biscuit made in Niagara Falls from Dakota wheat. He sugars it with the product of Cuban cane. He puts Wisconsin butter or bread baked of Minneapolis wheat flour mixed with Illinois corn flour (this was during the war). He has a potato. In June it comes from Virginia, in July from New Jersey, in November from New York, Maine or Michigan. If he indulges in meat, it is a lamb chop from a frisky little beast born on the high plains near the Rocky Mountains and fattened in an Illinois feed lot before going up to Chicago to be inspected, slaughtered and refrigerated. He warms and wakes himself up with a cup of coffee from Brazil (called Mocha perhaps), or tea from Ceylon or Japan, or cocoa from Ecuador or the coast of Guinea." Dr. Smith might have added that he seasons his food with salt from Michigan, West Virginia or New York, and pepper from Singapore.

CHANGES TO BE EXPECTED IN THE FUTURE.

What is to be the development in the future? What can we expect one hundred years from now, assuming that our civilization does not collapse before then from its intolerable complexity? I think we may safely assume the following lines of development as certain to occur:

1. Still further improvements in transportation.

2. Improvements in present foods by development of new and valuable varieties.

3. Increase in crop yields, insuring more abundant and possibly cheaper foods.

4. The development of more scientific and economical methods of food conservation.

5. A wider distribution of useful foods of other countries.

6. The education of the consumer to overcome bad food habits and prejudices.

In looking forward to improvements in transportation we may assume that developments will be made along the line of perfecting refrigerating cars as well as cutting down the time of transportation between distant points. Great aerial fast freights may in future days link transoceanic continents with the speed and certainty that now connect outlying market gardens with any large city.

Improvements in varieties are constantly occurring, usually by design and occasionally by accident. The Concord grape, the Newtown Pippin apple and the Rome Beauty apple are outstanding examples of fortuitous occurrence. Only recently a monument was unveiled in Procterville, Lawrence Co., Ohio, by the Ohio State Horticultural Society to commemorate the origin of the Rome Beauty apple, which was accidently developed by a boy who planted a twig thrown away by his father at grafting time.

The Newtown Pippin is a pre-revolutionary apple, developed from a seedling discovered near Newtown, N. Y., and sent to Benjamin Franklin, who was instrumental in its propagation and dissemination.

The original Concord grape vine is still exhibited to tourists who visit Concord, Mass. Many excellent new varieties of foods are developed by scientific methods of study and propagation, and the name of Luther Burbank in this connection has become almost a household word, although credit must not be withheld from commercial seed houses and nurserymen.

The work of the Bureau of Plant Industry of the U. S. Department of Agriculture is also a great factor in this direction, for in addition to bringing in fruits, vegetables and nuts which are entirely new, the Bureau brings in varieties of existing food plants for the purpose of conducting hybridization and breeding experiments with the view of developing new qualities or disease-resisting properties. The office of Foreign Seed and Plant Introduction of this Bureau

maintains a number of field stations or experimental gardens. They are located at Miami and Brooksville, Florida; Chico, California; Bellingham, Washington, and Yarrow, near Rockville, Maryland. These stations cover a geographic and climatic range which make it possible to test plant and seed introductions from almost every clime.

From these experimental gardens the new plant material is distributed to State experiment stations and to private experimenters who are anxious to co-operate in this world-wide search for new and valuable foods.

The possibilities of increase in crop yields are being stimulated at present by agricultural organizations all over the land. Prizes are offered for authenticated record crops and particularly to young people, the awards being made at county or community exhibitions under the auspices of the grange or other similar body. We have much to learn from European farmers in this connection, and the older civilizations of Asia are far ahead of us in this phase of agriculture.

The development of scientific methods of food conservation and preservation has its greatest opportunity for the future in dehydration. This has already been thoroughly covered by Dr. Heber W. Youngken in a previous lecture of this course (*A. J. P.*, 1922, p. 4), but it may not be amiss to refer briefly to the outstanding advantages.

Dr. David Fairchild, in the *Geographic Magazine*, for April, 1918, very emphatically makes the contrast as follows:

"Fifty years ago we refused to eat the tomato because we believed it was poisonous; then we became so fond of it that we demanded it both in and out of season, even though it had to be grown thousands of miles from our markets, in the South or under glass. And for our Epicurean tastes we paid exorbitant prices. Then we learned to can this vegetable in great factories, and because we want our tomatoes stewed instead of as a sauce for macaroni or rice, we insist that the vast majority of our put-up product shall be in form for our immediate use—emergency ration shape; in other words, canned without being concentrated into paste, which is the way in which the Italians use their tomato flavor. In this dilute form 360 million cans of tomatoes are shipped over the country.

"There are two pounds and one ounce of tomatoes in a can, or a trifle over 1.8 cents' worth, and in a case of twenty-four cans, which sells for \$4 (this was during the war), approximately 43 cents' worth of tomatoes as picked in the field. This not only means that we

ship the tin cans in which the tomatoes are contained, but that we first ship the same number of tin cans from the factory where they are made to the cannery where they are filled.

"We have never learned and have never had to learn, until war's necessities forced the matter to our attention, that the tomato can be successfully sliced and dried; that it retains its characteristic flavor and aroma when so dried; that when soaked in water for four or six hours it comes back and makes a delicious sauce or soup, slightly sweeter than the canned tomato. For many ordinary uses of the household the dried tomato is as satisfactory as the canned product.

"One ton of good tomatoes, after peeling, trimming and packing in cans will weigh approximately 2300 pounds, when crated for shipment, whereas the same quantity, when dried and boxed is reduced to only 200 pounds, or about one-twelfth as much. In bulk the saving depends upon whether the slices are compressed or not. If left loose in the packages, the equivalent of ten carloads of the canned tomatoes could be packed in a single car, and when the car space required for moving the empty cans, block tin and packing case materials is considered, this number of cars is practically doubled."

In the case of spinach the contrast is even greater, for one pound of dehydrated spinach replaces a 60-pound case of canned spinach. In the case of dehydrated cabbage, it was found by actual test in an army camp, that five pounds of dehydrated cabbage, when soaked and prepared for the table by cooking, provided a serving each for more than 400 men.

So much for that phase of economy, which is convincing in itself. If it is true, as stated by a high official in the United States Food Administration, during the war, that "one-half of all the fruits and vegetables in the United States never reach the consumer," and that this terrible loss is due to careless and unscientific methods of handling, it would seem that dehydration would again be the answer.

If in every community where perishable foods are raised, a dehydration plant could be established, those portions of the crop that under ordinary conditions now go to waste could be dehydrated and thus quickly placed beyond the possibility of spoilage. This would increase the amount of available food and undoubtedly reduce prices.

At first glance, it would seem that such a development would be taking place even at the present time, but there are several factors working against this. First and foremost among these is the

opposition to, or rather apathy, regarding dehydrated foods on the part of the consumer. Many of them require a little more time to prepare an account of the necessity of restoring them by preliminary soaking, and this extra trouble counts heavily against a new product, no matter what its obvious advantages.

Then, considering the fact that eventually dehydrated foods will replace the more expensive canned foods, all of which are put up at present by private capital, it must be expected that opposition will develop in this direction.

Another bar to the progress of dehydrated foods is found in the fact that all are not equally good as now found upon the market and much harm can be done to the development of a new field of this kind by the sending out of products not representative of the highest state of the art. Indeed, our own Department of Agriculture, through its Bureau of Chemistry has done harm to the dehydrated food industry by distributing products of inferior quality and appearance as representative samples of what could be done in this connection.

There are a number of firms, mainly in the West, that are now putting out dehydrated foods of fairly good quality. The finest products I have ever seen have been prepared by a patented process, called the Cooke-Kelly Process, originated by Dr. J. F. Kelly, of Pittsfield, Mass., whose products are available by parcel post to those who wish to purchase. These do not require any soaking previous to cooking.

When these vegetables and fruits are restored, they are undistinguishable from the fresh fruits or vegetables by any tests, chemical, microscopical or organoleptic.

Under the heading of a wider distribution of useful plants, we are impressed by the fact that when we find anything in the food line that is new to us as individuals and take the trouble to investigate it more fully, we always discover that there is some part of the world where it is in common use or has been under cultivation. De Candolle says:

"Men have not discovered and cultivated within the last two thousand years a single species which can rival maize, rice, the sweet potato, the potato, the bread fruit, the date, the millet, cereals, sorghums, the banana or soy. These date from three, four or five thousand years, perhaps even in some cases, six thousand years."

The progress of the future, therefore, in its line, will be the introduction of food-yielding plants from foreign lands and the education of the food-consuming public to the use of the new foods thus made available. The most valuable factor in this connection in our own country is the work of the Bureau of Plant Industry of the U. S. Department of Agriculture. Under the administrative leadership of Dr. David Fairchild, Chief of the Bureau, there are sent to foreign lands experienced individuals called "agricultural explorers," who bring or sent back many entirely new foods, besides many new varieties of foods already in successful cultivation in America.

Among the new foods and new varieties which have been thus introduced are many which are enumerated in an article published by the author in 1918, entitled "Some New and Interesting Vegetable Foods and Fruits" (A. J. P., 1918, p. 170), which was abstracted from a lecture delivered before the Wagner Free Institute of Science. The more important of these which have already obtained a foothold are the avocado, the chayote, Chinese cabbage, dasheen, loganberry, soy, and the honeydew and casaba melons. Among the possibilities for the near future are the following:

The Colombian Berry, or Giant Blackberry of Colombia. This is a berry which grows abundantly in the wild state in the Colombian Andes and has never been brought under cultivation. The fruits are enormous as compared with our cultivated blackberries, the largest specimens described by Mr. Wilson Popenoe, the agricultural explorer, who studied the plant in its native home, measuring 2¼ inches long by 1½ inches in breadth. Plants and seeds have been introduced into the experimental gardens of the Bureau, and the development of this new plant will be observed with interest.

The Mango, which has been called the King of Fruits in Cuba, is another fruit which is being experimented with in this country, especially in Florida. Mr. Popenoe, who is in the investigator in charge of this fruit also, says that the real, luscious, enjoyable, edible mango has not yet appeared in our northern markets and that the stringy, insipid fruits of that name sold by the fancy fruiterers are not fair to the mango as known in its native clime.

The Pejibaye or *Chondaturo* is a tropical American counterpart of the Oriental date palm. It is cultivated in Costa Rica, Colombia,

Venezuela and Ecuador, and furnishes a staple foodstuff of numerous aboriginal tribes. While it is the fruit of a palm it is not sweet, but resembles the chestnut in flavor and character, and like it, is boiled in salted water previous to eating. This is one of the new foods that would have to be shipped to, rather than grown in this country, as attempts to cultivate it in Florida have not been successful thus far. The yield of the fruit is about 100 pounds per tree per year, which makes it a very valuable crop as the food value is very high. The calorific value is nearly equal to that of the avocado and more than double that of the banana.

The Pistache Nut is one of the introductions from China which seems to be obtaining a foothold in the west, being successfully grown in the Sacramento and San Joaquin valleys in California. At present all supplies of pistache nuts come from abroad, but those who have studied the subject and are familiar with conditions believe that the pistache culture will be of considerable importance in this country in the near future.

The Chinese Persimmon or Kaki is now being successfully grown in California and the South. The culture of this fruit is destined sooner or later to develop into an important industry. Dried persimmons form a staple food product of China and Japan.

The Jujube, from China, is another promising plant immigrant for the semi-arid South and Southwest. The tree bears a juicy fruit about the size of a plum, of a reddish or mahogany brown color when ripe. It is a good edible fruit when fresh, but when processed with cane sugar and dried it compares favorably with the date in flavor and nutritive value, and will undoubtedly have a large sale when supplies become available.

The Tangelo, which is a cross between a tangerine and a grape fruit (pomelo) has already made its appearance at some of the fruiterers, and may win a place for itself among lovers of citrus fruits in spite of its numerous seeds.

The Jaboticaba is a Brazilian fruit which is distinctive and peculiar in that the blossoms and fruit are produced directly on the trunk and main branches of the trees. The fruit is about an inch in diameter and consists of a mass of white, translucent, juicy pulp

surrounding a few oval seeds, enclosed in a tough skin, and with a flavor similar to that of certain varieties of the grape.

The Passion Fruit is another new fruit which has acclimated itself in some parts of the South. It is eaten out of hand and also made into jelly.

The Chilean Strawberry is a variety of that fruit which may have great possibilities in hybridizing, for it stands transportation well and has remarkable keeping qualities.

The Feijoa or pineapple guava is a South American fruit now grown in California which is described as having the refreshing taste of the pineapple, the richness of the avocado and the pungency of the strawberry with a tang of sassafras.

The Yam is a large tuber widely known and used in the West Indies and now successfully grown in Florida. It affords a change from the potato, which it somewhat resembles.

The Taro or *Dasheen,* which has already obtained a foothold in the South and some of the large cities of the North, is appearing in other varieties than the one originally introduced. The latest or Penang Taro, is almost like chestnuts in flavor when baked, and is excellent when French fried. Mr. R. A. Young, the plant introducer in charge of the Dasheen or Taro, says that there are many varieties of the Taro differing slightly in flavor or eating quality, just as do different varieties of apples.

The Udo, a popular Japanese vegetable, much used in salads, can be successfully grown in the eastern United States, north of South Carolina, and will become very popular when supplies are available.

The Sapote is a Central American fruit which grows well in Florida. It is the size of an orange and has yellowish flesh of soft melting texture.

The Roselle is a species of Hibiscus widely cultivated in the tropics and now grown in Southern Florida and Southern California for the fleshy calices which are used in jelly-making and for preparing a refreshing acidulous beverage.

The Cherimoya is a delicious tropical dessert fruit, which sometimes weighs several pounds and contains of a white soft pulp of a sub-acid, delicate flavor. It can be successfully cultivated in California.

The Sugar Apple is similar to the Cherimoya.

The Lingonberry is a close relative of the cranberry which is being brought in from Nova Scotia and Scandinavian Europe for use in jelly-making.

The education of the consumer in overcoming bad food habits and prejudices, is probably the greatest need of the present and one of the greatest hopes of the future. Few individuals can enjoy a wide range of variety of food. Prejudices regarding foods are stronger than any other, save perhaps religion. Whole peoples will go hungry rather than eat food to which they have not been accustomed.

David Fairchild says, in the article previously quoted: "The problem of feeding the Allies met with the stumbling block of unfamiliarity and prejudice. French and Belgians simply could not and would not use our cornmeal. Many would not use rice."

Apropos of the development of new food habits he says: "Could Sir John Hawkins have dreamed, when he introduced a Peruvian tuber as a curiosity into Ireland, that his great-great-great grandchild (if he has one) would see one hundred and fifty-five million bushels of potatoes produced in that island alone?"

"When King John of France was being taken to England after the battle of Poitiers, and one of the principal items of his expenditure was for sugar, one of the kingly luxuries of the day, could he have possibly imagined that the time would come when the descendant of a West African slave would remark in the language of his captors: 'It just seems like some one was dead in the house to have no sugar'?"

Concerning prejudice he says: "When you brand a food as no fit to eat how do you arrive at that conclusion? If it is a food that you have never eaten before how do you know that you are right? If it is one with which you are already familiar, how do you know that the difficulty does not lie in its preparation?"

Prejudices seem to be less strong in America, probably because of our various and mixed ancestry and our broad, geographic and

climatic distribution, affording ample opportunity for the development of distinctive local tastes, and as there are many tourists and travelers constantly passing to and fro, there is a greater variety of food consumed in America probably, than in any other land today.

Stefansson, the Arctic explorer, has written interestingly upon the subject of food prejudices of men and dogs. He says: "Dogs brought up around ships and used to foraging in slop pails and eating highly seasoned foods, will eat any food that we have ever offered to them. It seems, therefore, that a dog used to many sorts does not mind eating one food more. Dogs brought up on a diet restricted to two or three articles will, if they are more than a year old, refuse at first when an entirely new food is offered to them."

Similarly we have found "well brought up" men, used in their homes to a large variety of foods, both domestic and imported, take very readily to any new thing (such for instance as seal meat). But when "poorly brought up" and used to only a half dozen or so articles of food in their regular diet, are generally very reluctant to try a new food unless it has been represented to them in advance as an expensive or very delicious thing. Of course, here the situation is not so simple as it is with dogs. For one thing, the man of the laboring type has a feeling of being degraded when he is compelled to eat the food of "savages," while the man of the intellectual type is appealed to by the mild flavor of adventure in experimenting with 'native' food."

Besides a wider range of food in the next century we can certainly look forward to an era free from food adulteration and food debasement. The improvement that has been made within the past two decades is a guaranty in this respect.

The persistence of the use of white flour for upward of a century is one of the finest examples of crowd psychology possible, for the bread baked with it has neither the nutritive qualities nor the palatability of a good, whole wheat oaf. It will take many years before white flour (much of which is chemically bleached to make it appear still whiter) is replaced by the whole wheat flour which our ancestors ate and for the lack of which many of us suffer various ills. A hopeful sign is the announcement of the largest baking company in the country that they have at last perfected a 100 per cent. whole wheat loaf, which they are offering to their patrons and that they will not tolerate the use of chemically bleached flour.

It is probable, too, that with the great increases in population which will have occurred by the next century, meat will be esteemed more for its flavoring possibilities than as a staple article of diet and that it will be more difficult than it is at present to get an excessive protein dietary, which is such a detriment to the ordinary sedentary individual. It is probable that eggs will continue to be used and that the same meats will be found in the future as are found now with the probable addition of whale meat, which is extensively eaten in Japan and has appeared in our markets in the canned form. A single whale will yield 80,000 pounds of meat which can be cut out in 100-pound chunks of lean boneless flesh, which, when cooked, is not unlike boiled beef. Reindeer meat may also be used. Both whale and reindeer meat are now being sold on the Pacific coast.

The inhabitant of America one hundred years hence will probably have access to a wider variety of purer, cleaner food than we of the present time enjoy.

THE MODERN TREND IN PROFESSIONAL EDUCATION.*

ADDRESS BY PROF. J. W. STURMER.

(Dean of Science, Philadelphia College of Pharmacy and Science.)

Like a river winding through the mountains, bending hither and yon, flowing north, and south, and east, and west, according to the topography of the region traversed, but trending inevitably toward the sea, the forward movements in education are in a path exceedingly devious, but like the river, they do describe a distinct general direction.

We must not, however, carry our analogy too far. The river ultimately reaches the sea, whereas educational progress cannot be expected to reach its goal, which is perfection; for teaching is an art—not a science—and in the arts perfection recedes before us as does the horizon before the traveler. Like other arts, teaching involves the human factor, a most disturbing factor. Every student is not only another student, but is a different other—which may be said with equal truth about every teacher. Indeed, no curriculum,

*Delivered at the Founders' Day Exercises, on February 23.

no system, no school or college, can be expected to obliterate the great variability in the members of the human race. The results of education have, therefore, always fallen short of our expectations, and there is no hope that we shall ever be wholly satisfied with the achievements of our educational institutions. If we consider that the opinions as to what education should accomplish are quite diverse, and that the advice proffered is equally perplexing in its variety, we need not be surprised to find educational vagaries, sundry and various, and obsessions, not a few. Nevertheless, we see, when we investigate carefully, that in education, also, there has been progress which is substantial and real. We find further that its results taken by and large, have not been as discouraging as certain critics would have us believe.

Let us consider briefly a branch of higher education, namely, the education which provides the training for a profession, that is for a calling involving the application of science, and this in certain direct service to mankind—the education of the medical practitioner, the pharmacist, the bacteriologist, the works chemist, the engineer—the education of the men and women who have contributed so conspicuously to the development of the natural resources of our country, have done so much to provide the creature comforts which we enjoy, and helped in the conserving of life, health and well-being, in the community in which we live. This branch of education affects us all, and in a very direct and intimate way. It is, therefore, a matter of public interest and importance.

To trace professional education in America, from its early years of struggle to present-day conditions, showing its inter-relation to human progress, and indicating its contribution to civilization, would be a most engaging task. It would, however, require extensive research, and more time for the presentation of the findings than could be provided in an evening's program. It would in fact prove a worthy subject for a volume, of which the summary could hardly be compacted into a short address. We must, therefore, be content with a few observations on some of the more recent and more significant developments.

We are celebrating tonight the one hundred and first anniversary of the founding of the Philadelphia College of Apothecaries—the first of its kind on the American continent—founded at a time when higher education in this country was in the pioneer stage, and

was classical and bookish rather than professional. But the birth of the College was coincident with the modern renaissance, which took the form of a marvelous development in science and its application to human needs; and we find that from that time forward, professional education has progressed by leaps and bounds, in extent and variety, and has outdistanced the older education, based so largely on mere book-learning. In 1821, bacteriology was unknown, medicine was empirical, chemistry was largely chaos, and two professors could cover the ground adequately for students in pharmacy; whereas at present the faculty of this College consists of 40 persons, and there are nearly 100 schools of pharmacy, about 125 schools of medicine, and about 600 institutions listed as offering courses in chemistry of one kind or another. And as to students, the enrollment in the colleges aforementioned, equals, approximately, the standing army of the United States. Whether we should contend that scientific progress fostered the development of professional education, or should take the view that the latter proved conducive to discoveries in science, is as unnecessary as the argument regarding the priority of the egg or the hen. For science education and scientific advance are reciprocally helpful, one to the other, and constitute a beneficent circle by which humanity has profited immeasurably.

If now we study more closely the development of professional education, we find first of all that in the early periods entrance requirements were either non-existent, or were quite indefinite, and were expressed in a rather sketchy way, in general and loose phraseology. Let us contrast that condition with the practice of today, and note how definitely and specifically, the admission requirements are set forth in the current catalogue of a professional school. Moreover, the proceedings of the various associations of colleges disclose the prominence which the subject of admission standards has held in the deliberations of these bodies, and we can here trace the gradual advances which were made, necessitated in part by the increasing complexities of science courses, but in the main due to the realization that colleges cannot bestow but can merely develop intelligence. If we consider at this point the deductions which psychologists have based upon the results of the army mentality tests, made in 1917, which show that only a relatively low percentage of human beings can reasonably be expected to succeed in a professional course, or

become competent practitioners of a profession, we reach a new viewpoint as to the importance of admission standards. We see also why certain colleges are proposing to supplement the four-year high school entrance requirements with special entrance examinations and intelligence tests; for the entrance standards serve not merely to make sure of a certain amount of learning on the part of the student, so that there may be an adequate foundation for his college studies, but they are expected to function also as a barrier, to exclude those applicants who lack in capacity and capability, and who would be unsuited for a profession. In short, entrance requirements in the last analysis, are designed primarily to protect the public against the dangers which would result if the ranks of the professions were swelled by the mediocre or the incompetent; and, secondly, to protect the latter against the hazard of wasting years of their precious youth in fruitless or nearly fruitless endeavor. A deeper realization of these facts, and a more acute feeling of responsibility in this matter, is a rather recent development of professional education, as is also the acceptance on the part of the faculties, of the task—a most difficult one—of excluding the unprincipled and the vulpine, whose predatory instincts might lead them to use their attainments and skill to the detriment of the community. Most colleges see their public duty in this respect clearly, and while they recognize that the problems involved are extremely difficult, they are determined, notwithstanding, to face them, and to do all that is humanly possible to guard the gateway which leads to the professions, so that the moral and ethical standards of these callings may be preserved.

So much for recent and pending changes in the methods by which the student personnel is selected. Let us now consider briefly certain tendencies in the teaching of the sciences. First of all, we note a greater emphasis upon the fundamentals of science, for to apply science, we must have science to apply—that much is certain. No amount of specialization along narrow lines makes up for a poor grounding in the basal principles. The acceptance of this truth —for such it is now recognized to be—explains in a large measure the lengthening of the courses in the applied sciences.

Let us see how science grows. In the development of science, man first observed facts. Having collected a fair number, he next proceeded to correlate these facts; and as a final step has come generalization. All science was evolved in this manner, although it

should be remembered that in more recent times the facts observed were in many instances not observed in nature, but are experimental facts, developed by laboratory processes, deliberately planned, and carefully executed. But the point is, that only through the instrumentality of generalizations can we deal with new facts, and find our way through the great maze of data which scientists, through the years, have accumulated. Take, for example, chemistry. Its progress for centuries was slow and laborious, and its devotees spent their energies in many fruitless researches. But note its development counting from the time, a little more than a century ago, when sound chemical generalizations were reached. It has been shown also that to teach a few chemical processes, without reference to the theories, leaves the student incapable of independent progress—a mere cook-book chemist, to follow by rote the procedure which others have worked out. Hence it is that in properly training the student in any branch of applied chemistry, we must teach the essentials of chemical theory, and this means a more extensive course. Suppose we now give our attention to pharmacy, which in a certain sense is the mother of chemistry, and to the course offered as a training for pharmacy, a calling which is based not on one science, but on several, namely on physics, chemistry and certain branches of biology. We still have the minimum course of but two college years, the course which meets the legal requirements as a preparation for pharmaceutical practice. But even here we observe the tendency toward fundamentals rather than toward the inclusion of a perplexing multiplicity of details; and to make room for a more thorough grounding in these fundamentals, and for a more logical sequence of subjects in the plan of study, this course will in the near future be lengthened by an additional college year. Like medicine, dentistry, or engineering, pharmacy is becoming more and more scientific, requiring that greater emphasis be placed upon the teaching of the essentials of science, and time and opportunity must be provided for this much-to-be-desired improvement.

Pharmacy, an ancient art, which for many years developed along empirical lines, has provided the initial training for many noted scientists—chemists, microscopists, botantists, mineralogists; and in colleges of pharmacy we may see a corresponding specialization along certain lines of applied science. This, to be sure, is a laudable adjustment to new conditions. But a more significant advance in

pharmaceutical education is indicated by the four-year course, planned in conformity to accepted academic standards, and providing not mere variety of specialized work, but a broad, liberal foundation for such work. This represents indeed a substantial advance, along logical, common-sense lines, and it will contribute greatly in maintaining the true professional standing of this calling. It is the step forward which again adjusts pharmacy to the present-day status of the sciences upon which it is based. Any profession which fails to emphasize its science basis, will, we know, become stagnant and non-progressive. If pharmacy were to perpetrate this blunder, it would speedily revert to empiricism, and its research would pass into the hands of physicists, and chemists, and biologists, of other fields of practice, with the result that pharmacy itself would become a thing lifeless and without a future.

As has been stated, pharmacy, an integral part of medicine, responsible for the manufacture and the standardization, and the preparing for the medical practitioners, the medicinal materials employed in the healing art, embraces applications of the several physical sciences. A thorough education in pharmacy must accordingly contemplate the teaching of the fundamentals of these sciences. But physics and chemistry cannot be studied without aid of mathematics. Therefore, a carefully planned course in this science has been added to the curriculum. Next we come face to face with the fact that in scientific investigations it is necessary to search the literature of foreign investigators. This leads to the inclusion of German and French. And finally, we come to the requirement which transcends all others, namely, that the student of science be well versed in the language in which his text books are written, his lectures are given, his recitations are conducted, and in which he must transmit his own thoughts, namely, English. If we lack words, or do not know how to assemble the right words to clearly express our ideas, our thought stream is a sluggish, colloidal stream, incapable of transfusion. English is the very backbone of every college course, whether in be in engineering, chemistry, or pharmacy. Noted engineers and famous chemists have seen fit to call attention, time and again, to the outstanding importance of a mastery of English as a factor in the advancement of every practitioner of a profession. The scientist or professional man who cannot express himself clearly, and with such force or grace as the occasion may require, is indeed under a handi-

cap, and no superiority along other lines compensates wholly for this deficiency.

So we come inevitably and quite logically to the conclusion that a thorough and liberal education in pharmacy should comprise four years of study, the first two years being devoted to the basal physical sciences and to mathematics and the languages, and the two higher years, to the professional branches. And when we compare the plan of study constructed on these lines with the curricula of our universities, we find that we have practically paralleled their courses in science and in engineering. We find also that in our Freshman and Sophomore years we have duplicated the two-year pre-medical course, required as a preparation for the study of medicine.

Conclusions reached independently by these three professions—engineering, medicine, and pharmacy—certainly deserve our serious consideration. So it has come about that the edifice of pharmaceutical education, after a number of minor additions, is now being raised off its rather flimsy foundations, and is being provided with a more substantial support, built solidly and in a workman-like manner, which assures the permanence of the structure.

As has been explained, the subjects of the two first years of the four-year course have been included for specific utilitarian reasons. But shall we say that they have no cultural value? What are the peculiar attributes of a study which qualify it for classification as a culture subject? What precisely is culture? We know that in certain academic circles, particularly in Europe, it is customary to speak of professional or technical studies as though they represented the antithesis of the cultural. If this is merely for convenience in grouping, we agree—mainly because we wish to be agreeable. We have no desire to open an academic debate with the classicists, who are largely responsible for this classification, and we would certainly not undervalue classical learning. We fail to see, however, why the writings of Democritus, in which we find set forth his rather hazy concept of the atom, should, if read in the original, be cultural, and the marvelous story of the developments of modern chemistry, which in its creative powers has "beggared the Lamp of Aladdin," be deemed devoid of cultural possibilities. It would seem that such a conclusion must be based upon a rather pedantic definition of the term culture. As we Americans interpret the word, it is not remoteness, nor antiquity, nor relative uselessness, nor is it anything

which leads merely to a meticulously correct use of language, which makes a study cultural, a term which to us implies all those things that tend to enrich and refine life, involving ideals which are of the heart, as well as ideas which are of the mind. "Not through language alone, nor through science alone, is human nature made whole," said Tyndal in his famous Belfast address. And not through language alone and certainly not through the classics alone, do we achieve culture. America has no leisure class—except the hoboes. All the rich, as well as the poor, are expected to perform some useful work. The mere scholar whose sole purpose it is to absorb vast stores of learning, is no more an object of admiration, than the freak who can consume six dozen oysters or ten pounds of beefsteak. Our applause is for the man who eats a normal ration, and fits himself physically to perform a useful piece of work. In like manner, it is not the scholar with an astonishingly high "absorptive index" for learning, but rather he who has a good "working knowledge," knows how to use reference books, and who *does something in his professional capacity,* is esteemed and admired. And this American attitude toward the productive worker, influences our conception of culture, at least to a certain extent. So we have come to think of culture as something which not only conduces to the happiness of the person who possesses it, but which also makes him pleasanter to deal with, to work with, to be with.

And with this broad American interpretation of the term in mind, we do not hesitate to contend that professional schools, as well as classical schools, are, and must be, centres of culture. In other words, it is not the sole function of such schools to teach their students how to achieve certain results with test tubes, or the microscope, or the scalpel, or the mortar and pestle. Indeed, no. It is expected rather that our graduates be men and women of refinement, men and women with ideals, with a philosophy of life which is sane and tolerant and tinctured with the touch of human altruism—men and women who have learned to make a living in some professional activity,—yes,—but who have also learned how to live a good life, full, satisfying, and of benefit to the community in which they chance to practice their calling. And this, I am sure we shall all agree, is a distinction with a difference, indeed, a great difference.

Finally the country expects that its professional schools be training camps for loyal, patriotic, American citizens. A few short

years ago, when the bugle call sounded, and our young men flocked to the colors, the nation as a whole caught the "rhythm of marching men." How splendidly did the colleges, at that critical time, give evidence of their loyalty! And how speedily they were converted into training camps for soldiers and sailors! Yet when there came peace, these colleges returned gladly to the task of training men and women for the pursuits of peace. But they are Uncle Sam's training camps just the same; their spirit is just as patriotic, and in these troublesome times their services just as necessary. When our country called, many a student left his books with the remark that he was embarking for "the great adventure." But is not the developing of our national resources, the improvement of the health of our citizens, the advancement of science, also a great adventure? And does not our country continue to call for recruits, now to serve in its army of peace? And if so, are not our professional schools just as necessary to the nation, though in a different way, as are West Point and Annapolis? Fortunate it is that at no time in the country's history have the colleges realized more keenly their solemn duty to the State. Addresses on citizenship, on patriotism, on the duty of service for the public welfare, on professional ethics and on kindred topics, now constitute an essential feature of the college curriculum, in order that our soldiers of peace also may possess that splendid loyalty and morale which characterized our boys in the camp and field.

—Yes—no doubt—our pedagogical Jeremiahs may find in modern education much ground for criticism and for pessimism. But the graduate who at college experienced his mind's awakening, was touched with the divine spark of inspiration, found a guide in the pursuit of happiness, learned to see more clearly his duty to his fellowman, and his obligations to the State, will, through the years, even after he has passed life's meridian, and hit the sunset trail, hold his college in loving memory, as he does the home of his childhood. With him the words Alma Mater will have a deep significance, and when he speaks them, it will be no mere lip service. The sight of her emblem will affect him as the view of the Star Spangled Banner in the home harbor thrills the returning traveler. How specious, and hypercritical, and altogether inconsequential, appear to him the attacks on the colleges—which fortunately are in no danger of that complacent self-sufficiency which prevents progress, and therefore can profit but

little by such criticism.—True, professional education does not always make headway in a straight line, to a goal in plain view. Like the river winding through the mountains, its movements are tortuous, bending hither and yon; but in the things which count most, its general trend is unmistakably governed by the conviction that the future of our civilization will to a large degree be in the hands of those who are passing through the portals of our colleges.

Any college which has this conviction, accepts the responsibilities implied, and frames its policies accordingly, need have no misgivings about its future.

THE STABILITY OF ARSPHENAMINE SOLUTION.

By Peter Masucci,

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Arsphenamine appears on the market in the form of an amorphous yellow powder. Chemically, it is the dihydrochloride of 3, 3, diamino, 4-4- dihydrozy-arseno-benzene. An aqueous solution ot Arsphenamine is acid, having a hydrogen ion concentration of about pH 4.8. The solution must, therefore, be neutralized before it can be injected intravenously. The addition of two molecules of sodium hydroxide precipitates the free base; three molecules form the soluble monosodium salt; and four molecules form the disodium salt, the form best suited for intravenous injection. The reaction of the disodium salt is decidedly alkaline or a pH of 9.4.

The prevalent view is that the dihydrochloride of Arsphenamine is very unstable in air, but the work of Voegtlin and Smith (1) showed that it is exceedingly stable to atmospheric oxygen. In alkaline solution, however, oxidation takes place very rapidly. Roth (2) showed that shaking alkalinized Arsphenamine for ten minutes in the presence of air increased the toxicity at least 60 per cent. Myers (3) seems to think that shaking has been over-emphasized, for it has been proved that shaking acid solutions causes no harm, and at low temperatures little harm is caused with alkaline solutions. Lake[4] showed definitely that there is a decrease in toxicity when Arsphenamine is allowed to stand thirty minutes or more after the addition of alkali.

In order to obtain more data on the keeping qualities of Arsphenamine solutions, a series of experiments was planned to determine (1) the increase in oxidation of the disodium salt solution to its corresponding oxide and (2) the increase in toxicity. These two factors were determined on solutions kept at room and ice-box temperatures in ampules from which the air had been displaced by nitrogen gas.

At the suggestion of William M. Clark, of the U. S. Hygienic Laboratory, the following procedure was used to fill the ampules under nitrogen gas: 15 grms. Arsphenamine were dissolved in 2865 cc. distilled water. The air in the bottle containing the solution was replaced by nitrogen gas. The theoretical amount of alkali, 135 cc. normal NaOH was added to the solution and nitrogen was again bubbled through to dissolve the precipitate formed upon the gradual addition of the alkali. The clear solution, containing 5 mgms. of Arsphenamine per cc. was now candle-filtered using nitrogen as a source of pressure. The air in the filling apparatus was displaced by nitrogen and the solution was filled into 80 cc. ampules from which the air had been previously displaced by nitrogen. At no time was air allowed to come in contact with the solution.

Part of the filled ampules were held at room and part at ice-box temperature. Control ampules of Arsphenamine solution of similar concentration in contact with air were also kept. From time to time samples were taken and observed for change in color and appearance of precipitate. Determinations were made to show increase in oxidation and toxicity.

Arsphenamine is oxidized by iodine quantitatively; each molecule of Arsphenamine requires four atoms of oxygen. The degree of oxidation resulting in the solutions on standing can be followed very closely by this method. At certain intervals samples were taken and titrated with standard iodine in an acid solution.

The toxicity of the solutions was determined from time to time by injecting into white rats according to the method prescribed by the U. S. Hygienic Laboratory.

Table I shows the degree of oxidation which took place in the solutions, change in color and formation of precipitate. Table II shows the results of the toxicity tests.

TABLE I.

Date	Solution	Color	% Oxidized	Precipitate
8/10/21*	under air, room t°	yellow	0	none
	" " icebox t°	"	0	"
	" nitrogen, room t°	"	0	"
	" " icebox t°	"	0	"
8/17/21	under air, room t°	green	25	very heavy
	" " icebox t°	red	10	none
	" nitrogen, room t°	yellow	0	"
	" " icebox t°	"	0	"
8/26/21	under air, room t°	green	35	very heavy
	" " icebox t°	"	20	" "
	" nitrogen, room t°	reddish tinge	2	none
	" " icebox t°	yellow	0	"
10/20/21	under nitrogen, room t°	very red	10	"
	" " icebox t°	yellow	0	"
11/15/21	under nitrogen, room t°	very red	8	"
	" " icebox t°	yellow	0	"
12/28/21	under nitrogen, room t°	very red	9	"
	" " icebox t°	slightly reddish tinge	2	"

*Date solutions were prepared.

TABLE II.

	Solution kept on ice					Solution kept at room temp.				
	No. injected	Healthy	Dead in 2 days	Dead in 2 weeks	Live 2d week	Injected	Healthy	Dead in 2 days	Dead in 2 weeks	Live 2d wk.
Fresh	5	4	0	0	4	5	4	0	0	4
1 wk.	6	3	3	0	0	6	5	1	1	3
2 wk.	5	5	0	2	5	5	5	0	1	4
3	6	5	0	2	3	6	3	1	0	2
4	6	5	0	0	5	6	6	1	0	5
5	6	6	0	0	6	6	4	0	0	4
6	6	6	0	0	6	6	5	1	0	4
7	6	6	0	0	4	6	5	3	0	2
8	6	4	0	0	4	6	5	5	0	1
12	6	5	0	1	4	6	6	4	0	2
16	6	5	0	0	5	6	6	6	0	0

The above results may be summarized as follows: Arsphenamine solutions can be kept under nitrogen gas at ice-box temperature for four months without a noticeable change of color, increase in oxidation or toxicity. Solutions kept under nitrogen but at room temperature begin to show a change in color from yellow to a reddish tinge in about two weeks; at the end of eight weeks about 10 per cent. becomes oxidized with a very noticeable increase in toxicity. The experimental data indicates very clearly that the temperature at which solutions are kept is a very important factor. The oxidation of Arsphenamine to the so-called "arsenoxide" takes place

much more rapidly at room temperature than at ice-box temperature. This fact might be used in the preparation of Arsphenamine solutions for intravenous injections where a certain amount of shaking is necessary in order to get the drug in solution. Shaking at low temperature should not cause any material increase in toxicity.

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NOTE ON THE OIL OF AGASTACHE PALLIDIFLORA.

By James F. Couch,

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The giant hyssop, Agastache pallidiflora (Heller), Rydb.[1], is one of the labiates. It is widely distributed throughout the mountainous regions of the far west and Pacific coast and, in some districts it is very abundant. The material which was used in the following experiments was obtained at the Experiment Station of the Bureau of Animal Industry, at Salina, Utah, situated at an altitude of about 8,000 feet, and in the Wasatch range.

The writer's attention was first directed to this plant by the very intense, fragrant odor which diffuses through the air in its neighborhood. Before the blossoms of the plant have opened the odor noted resembles that of thyme; after blossoming the odor is more like a mixture of thyme and peppermint. The leaves of the plant bruised between the fingers develop a strong thyme odor; the flowering heads, subjected to the same treatment, yield an intense peppermint odor with a small thyme component. It was,

[1] Botanical designation furnished by the Bureau of Plant Industry, U. S. Department of Agriculture.

therefore, thought of interest to investigate the essential oil of this plant as a possible source of thymol or menthol.

Accordingly several collections of flowering heads and of leaves were made and the fresh material was immediately, except for one experiment, subjected to steam distillation. The quantities used and the yields of dry oil were as follows:

July 28,	3720. Gm. Flowers,	yielded	6.84 Gm. oil	0.184%
Aug. 5,	2560. Gm. Flowers,	"	3.96 Gm. "	0.155%
Aug. 11,	3500. Gm. Flowers,	"	11.06 Gm. "	0.316%
Aug. 17,	950. Gm. Leaves,	"	0.79 Gm. "	0.083%

The first flowers collected were just beginning to open and full maturity was not attained until about two weeks after when the third lot was collected. This probably accounts for the larger yield of oil from the lot of August 11. The lot of August 5 was ground through a meat chopper and allowed to stand over night before distilling. Contact with the air turned the ground material deep brown possibly through oxidation of some phenolic constituent. The leaves used were carefully separated from the stems of the plant. These stems are coarse and fibrous and do not appear to contain oil. The leaves were then ground through the meat chopper and steam distilled.

The oils obtained from the flowers all carried a very penetrating peppermint odor with some marked suggestion of thyme. They were slightly yellow. The oil from the leaves had a rank thyme odor only. None of the samples of oil, nor any of the aqueous distillates containing dissolved oil affected ferric chloride solution and all were neutral to litmus.

The following physical constants were determined for the oil from the flowers:

Density at 20°	0.91924.
Specific rotatory power, at 25°....	—8.60°
Index of refraction at 25°	1.4865.

The oil is soluble in the ordinary solvents. On cooling to —10° and letting stand at that temperature for several hours there was no separation of any crystalline material. Consequently, the amount of free menthol, if any, present cannot be very large. Phenols were tested for by the usual absorption method using 5% NaOH. The

volume of the oil diminished slightly, but on acidifying and shaking out the aqueous layer with ether, no phenols were found. Pulegone and other ketones were tested for and found absent.

The small quantity of material did not permit a more extensive investigation of these oils. In addition the writer cannot now devote to this subject the time necessary to complete the chemical examination. Therefore, this note is published in order to record the known facts and to direct attention to this interesting volatile oil.

THE EVOLUTION OF CHEMICAL TERMINOLOGY.
II. PHOTOTROPISM. ORGANOTROPISM.

By James F. Couch.

In an earlier paper [1] I discussed some of the causes of ambiguity and confusion in the application of chemical terms. Another source of confusion arises in the specific use of similar or identical terms to describe dissimilar phenomena in different sciences. The terms may have been coined independently from the Latin or Greek roots by scientists working in widely different fields and yet, with the broader extension of chemical control in natural processes, the separate phenomena may be recognized as essentially chemical and the term becomes a chemical word with two or more distinct meanings.

An excellent example of this condition occurs in the terminology manufactured out of the Greek word τροπή, "a turn." The idea of turning is variously used in science to express change, reversal, arrangement, readjustment, circular or spiral propagation and intramolecular rearrangement. All of these processes have contributed to the collection of terms under consideration. The Greek work is anglicized "tropism" and this term has been used in a very specific sense by biologists and physiologists.

A tropism is a forced movement towards or away from some source of stimulus or is an adjustment of a body so as to minimize or equalize the effect of some external force. As generally applied it has always referred to living things and the usual definitions of the term restrict it to organisms, *viz.*, "The turning or move-

[1] This Journal, 94, 91-6 (1922).

ment of protoplasm or organized matter in relation to external matter or influences," "The inherent tendency of a living thing to respond definitely to an external stimulus," and "The innate tendency of the organism to react in a definite manner to external stimuli. . . ."

A more detailed and definite statement and one which gives us some insight into the mechanism of tropistic behavior is the following from Jacques Loeb.[2]

"Normally the processes inducing locomotion are equal in both halves of the central nervous system, and the tension of the symmetrical muscles being equal, the animal moves in as straight a line as the imperfections of its locomotor apparatus permit. If, however, the velocity of chemical reactions in one side of the body, *e. g.*, in one eye of an insect, is increased, the physiological symmetry of both sides of the brain and as a consequence the equality of tension of the symmetrical muscles no longer exist. The muscles connected with the more strongly illuminated eye are thrown into a stronger tension (we are speaking of positively heliotropic animals exposed to only one source of light), and if new impulses for locomotion originate in the central nervous system they will no longer produce an equal response in the symmetrical muscles, but a stronger one in the muscles turning the head and body of the animal to the source of light. The animal will thus be compelled to change the direction of its motion and to turn to the source of light. As soon as the plane of symmetry goes through the source of light, both eyes receive again equal illumination, the tension (or tonus) of symmetrical muscles becomes equal again, and the impulses for locomotion will now produce equal activity in the symmetrical muscles. As a consequence, the animal will move in a straight line to the source of light until some other asymetrical disturbance once more changes the direction of motion."

The foregoing describes a tropism the stimulus for which is a source of light. The phenomenon is termed heliotropism or heliotaxis, and phototropism or phototaxis, the last named being the more preferable for several reasons which I shall develop below. Common instances of this phenomenon are seen in the attraction of moths to flames, of sea birds to the giant reflectors in light-houses, and in the bending of house plants toward the window.

[2] Forced Movements, Tropisms, and Animal Conduct. Vol. 1 of Monographs on Experimental Biology. Philadelphia. J. B. Lippincott Co., 1918, p. 13.

There are, however, many other stimuli which may result in tropistic behavior and the specific response to each has been in every case distinguished by a particular name. We recognize geotropism (geotaxis) in which the force of gravity (as exerted by the earth) is regarded as the stimulus. Tropistic reaction to any stimulus produced by chemical inequalities in the environment of an organism is termed chemotropism (chemotaxis) a special case of which is hydrotropism in which the stimulating substance is water. Reaction to difference in temperature is thermotropism (thermotaxis); response to contact or other mechanical stimulus is thigmotropism or stereotropism; and reaction to electric stimuli is electropism. Rheotropism or rheotaxis is "the phenomenon of a body moving in a direction contrary to the current of the fluid in which it lies," a special case of which is anemotropism in which the organism adjusts itself to the direction of the wind. Loeb considers rheotropism and anemotropism as due to a tendency toward fixation of a moving retina image.

In all of the foregoing reactions to external stimuli the tropism is manifested by a change in the direction of motion, or of propagation, or an adjustment of spatial relationships. These may be considered characteristic of tropistic behavior.

In the domain of pure chemistry the word tropism or a derivative of it has been used in the formation of a number of terms none of which describe phenomena that relate to true tropistic behavior. There are desmotropism and merotropism for dynamic isomerism; phasotropism for a virtual tautomerism; and allelotropism for a condition of tautomeric equilibrium. There is again the well-known allotropism of the elements so strikingly shown by carbon. From the physicists we get the terms isotropism and anisotropism referring to the physical equality of the properties of a body when viewed from different angles.

The zoologists employ the terms dextrotropic and dexiotropic to indicate that the direction of propagation of the spiral in certain shells is toward the right or clockwise.

Other tropistic terms which may be mentioned are, parasitotropic, "having special affinity for parasites," of which the noun is parasitotrope; eosinotactic, "exhibiting an attractive or repulsive influence upon eosinophile cells," and the chemotherapeutic terms, organotropism, which may be defined as the chemic affinity of sub-

stances for the organs or tissues of the body, and neurotropism, a special case of organotropism, "the attractive influence which nervous tissue exerts upon nutritive and other substances." It is part of the purpose of this paper to consider the term organotropism and its satellite, neurotropism.

Our interest in the other term which forms part of the present title arises from its use by the physical chemist. While phototropism is used by the biochemist to denote the tropistic response to light stimulus; in the vocabulary of the physical or photochemist it indicates a reversible isomeric change due to the influence of light energy and accompanied by a color change. The same term is used to label two essentially different chemical phenomena which come to us from the most diverse scientific sources, biology and optics.

Fortunately a satisfactory remedy is available. One may substitute for "tropism" in biological terms the suffixes "taxis" or "taxy," derived from the Greek *τάξις*, arrangement, adjustment, or order. Phototropism then becomes phototaxis and indicates, instead of a turning to or from light, an adjustment with reference to light. This change is preferable because we know that any change in the direction of motion of a tropistic animal or plant is merely incidental and not essential. The newer form has been used by the more careful writers and we are now well accustomed to the terms chemotaxis, heliotaxis, geotaxis, etc. The generic name for the phenomena will remain as it occurs today, tropism, for it is well established and there is no convenient substitute for it.

The suggested change has also the advantage of leaving the field free to the chemist not only in the use of the term phototropism, but also in the use of allelotropism, desmotropism, phasotropism, allotropism, and so on.

When we consider the term organotropism, however, the situation is different. There is, in physiology, a number of terms derived from the Greek word for nutrition, *τροφή* trophism, the phenomenon of nutrition; trophic, pertaining to nutrition, and so on. It is obvious that there is great liability to confusion between tropism and trophism. Conflicting with organotropism there is organotrophism, a term relating to the nutrition of the tissues; conflicting with neurotropism there is neurotrophism, a term which designates the nutrition of the nervous tissue. The crowning achievement of term combination may now be mentioned; it consists of the

two very enlightening terms, "trophotaxis" and "trophotropism." The first of these indicates "the movement of cells in relation to a supply of food" and the second denotes "the chemotaxis of the nutritive matter of cells."

It is clear, I think, that the position of the term organotropism is untenable. The physiologist's organotrophism is the older term and, from classical as well as scientific considerations, it does not violate good taste. We cannot convert the former into "organotaxis" and thus save it for it defines a phenomenon which is not a tropism. The acceptable form of the term would be "organophilism" with the adjectives "organophil" and "organophillic," for the essential force which operates to produce the phenomenon is chemical attraction. Similarly neurotropism may become neurophilism. These phenomena will then take their proper place beside eosinophilism.

There is an attraction between certain tissues and some substances through which those substances tend to accumulate in certain organs or cells, but we cannot argue that the attracted molecule responds tropistically to a stimulus. If we affirm that we shall also be obliged to attribute tropistic behavior to particles of iron which move under the influence of the magnet. Although there is little question that tropistic behavior is fundamentally purely mechanistic and depends upon the law of mass action, the term tropism is confined to the reaction to stimulus of organized matter which is capable of free and self-initiated motion in the absence of limiting stimuli, and which responds to stimuli only because of its capabilities for free and self-initiated motion.

SUMMARY.

I. The terms phototropism, geotropism, chemotropism, etc., as used by biologists and biochemists to describe true tropistic behavior should be discarded in favor of the preferable terms, phototaxis, geotaxis, chemotaxis, etc.

II. The term phototropism as used by the photochemist to describe the reversible isomeric changes produced by light energy may be retained as such.

III. The chemotherapeutic terms organotropism and neurotropism should either be discarded or should be changed to organophilism and neurophilism.

IV. The word tropism is retained as the generic term for phenomena of true tropistic behavior.

ABSTRACTED AND REPRINTED ARTICLES

REMOVAL OF STAINS FROM TEXTILES.*

In the *Scientific American Monthly* for July, 1921, Harvey V. Elledge and Alice L. Wakefield discuss the removal of stains from wash goods. This article was originally written for laundry owners and is accompanied by a "procedure chart," which tells at a glance what reagent to use for removing the various stains in the washing of cotton, linen, wool and silk.

The writers recommend the following reagents for the removal of stains:

Acids.	Alkalies.	Oxidizing reagents.	Reducing reagents.	Solvents.
Oxalic. Hydrochloric. Acetic.	Caustic soda. Soda ash. Ammonia. Potassium-cyanide.	Javelle water. Hydrogen dioxide. Potassium permanganate. Sodium perborate.	Sodium bisulfite. Sodium bisulfite used with zinc. Sodium thiosulfate.	Ethyl alcohol. Amyl alcohol. Ethyl ether. Acetone. Aniline. Chloroform. Carbon tetrachloride. Carbon disulfide. Benzine. Kerosene. Gasoline. Oleic acid.

The acids and alkalies and the oxidizing and reducing reagents are used as a rule, well diluted.

The various stains encountered in laundry work are removed as follows:

"*Albumin.*—The regular standard washing process includes a lukewarm first bath for the purpose of dissolving any albuminous materials that may be present.

"*Blood.*—The albuminous portion of this stain is removed in the first bath of lukewarm water; the stain proper, which is due to

*Reprinted from the *Naval Medical Bulletin.*

the hemoglobin or coloring matter of the blood, is removed in the bleach bath. If the fabric is of the kind that can not be treated with Javelle water, the stain may be treated with hydrogen dioxide.

"*Bluing.*—Bluing is of three kinds—ultramarine blue, that gives the desired color by depositing small insoluble particles of blue on the fabric; Prussian blue, that dyes the fabric with a soluble dye; and aniline blue, that dyes the fabric with an insoluble dye. Ultramarine blue, which only gives trouble by being used too heavily, may be removed by simple washing; Prussian blue, which in an alkaline bath is changed to iron oxide and gives a rust stain, has to be treated with oxalic acid solution. The aniline blues, if used too freely, dye the fabric permanently as far as the ordinary solvent water is concerned and must be removed by treatment with oxidizing or reducing agents, according to the nature of the dye used. Javelle water, or potassium permanganate solution, is used to oxidize these blues on cotton or linen fabrics while potassium permanganate solution or hydrogen dioxide is used on silk and wool. Sodium bisulfite solution and zinc may be used on both the animal and vegetable fibers as a reducing agent. The potassium permanganate solution treatment is not complete in itself, as it leaves a brown stain of manganese dioxide in the cloth, which must be removed by treatment with oxalic-acid solution. If it is found necessary to repeat the treatment, the excess oxalic acid should be washed from the fabric before more permanganate solution is applied. It is always well to observe the precaution of rinsing from the fabric any excess of solution when two solutions are alternated, because the excess of solution present reacts to neutralize the effect of the other solution in a manner that has no effect in the removal of the stain. There is no need for such useless reactions.

"*Cocoa and chocolate.*—These stains occur in most cases on white table linens and when too deep to be removed by the water and soap are removed by the bleach bath in the ordinary laundry way.

"*Coffee.*—Javelle water, applied in the bleach bath, removes this stain effectively.

"*Cream and ice cream.*—The principal ingredient that causes trouble in this type of stains is the butter fat present. When this

is removed with hot water and soap, the stain is usually gone completely. In the case of an ice cream that has fresh fruit juice or a food die present as coloring matter the stain will be removed by Javelle water.

"*Dyes.*—The treatment for a dye stain has always to be determined by a few tests on some portion of the stained fabric. The first trial may be made with Javelle water; then with permanganate solution, then with sodium bisulfite solution and zinc. The kind of material involved and the dye itself have to be taken into consideration for the successful treatment of this type of a stain. The removal of hat dyes is facilitated by treatment with 95 per cent. ethyl alcohol, in which the greater portion of the dye is soluble. A residual stain may have to be treated with one of the oxidizing or reducing agents.

"*Egg.*—This stain is partly albuminous, partly fatty, and in most cases will be removed by a formula that includes a lukewarm first bath and hot suds.

"*Fruit.*—Fruit stains can readily be removed by treatment with Javelle water.

"*Grass.*—This stain is also removed from cotton and linen by treatment with Javelle water. Silks and wools are treated with a mixture of equal parts of ethyl alcohol and ethyl ether. This is a solvent for the green dye present in grass.

"*Grease.*—The average grease stain is removed in the standard washing process. Any stain that survives this treatment may be softened with oleic acid and lard and washed in a hot solution of soda ash. If the grease has contained a mineral staining agent like iron or some type of dyestuff, it can be treated specially, as described under these headings. The best treatment to be accorded to silks and wools is with one of the many grease solvents. . . . The solubilities of the different types of grease vary with the different solvents, and it is often necessary to experiment with several solvents before the most efficacious one is found.

"*Gum or resin.*—The type of the gum or resin decides the solvent that should be used. Common chewing gum is soluble in

carbon tetrachoride; varnish is soluble in alcohol; resins are soluble in ether, alcohol, and turpentine, the source of the resin determining which solvent is best. Since there is no way to decide which resin is present, the method of trial and error must be applied to discover which solvent is to be used.

"*Ink*.—Iron inks are best removed by treatment with warm oxalic acid. If such treatment does not remove the stain completely, it is possible that the ink has been a mixture of iron ink and an aniline dye, in which case a second treatment with Javelle water is necessary. India ink and printers' ink are both suspensions of carbon in a gum-like medium, and should be removed ni the regular laundering process. If such treatment is not effective, the stain may be loosened with lard and laundered again. Silver-nitrate inks have to be treated with sodium thiosulfate or with Javelle water. Javelle water converts the silver to an insouble, colorless salt that has to be removed by treatment with dilute ammonia water. If this precaution is not taken, the silver may again oxidize to the colored salt and the stain reappear. Indelible pencils contain both graphite and an aniline dye; the dye can be removed by treatment with Javelle water, while the graphite will be washed away mechanically.

"*Iron*.—The specific treatment for iron stains is warm oxalic-acid solution.

"*Leather*.—Javelle water has been found to remove these stains from the cotton and linen fabrics, but in the case of silks and wools the stain is permanent.

"*Medicines*.—The medicines containing organic materials are usually removed in the regular laundry process; any stain surviving this treatment can be treated with Javelle water. The medicines containing salts of the heavy metals, like iron, silver, etc., may be treated with potassium cyanide. The cyanides of these metals are water soluble and are removed by means of this solvent after conversion has taken place.

"*Mildew*.—These stains are usually removed in the standard washing process, but heavy stains may have to be treated alternately with Javelle water and oxalic acid.

"*Mud.*—The mud itself is removed in the regular water washing, but a residual stain of iron is often encountered. This is treated, as all iron stains are, with warm oxalic acid.

"*Paint and varnish.*—These stains are best removed before laundering. They may be loosened by treatment with oleic acid and then laundered, or they may be treated with one of the solvents that are given in the table of reagents. The character of paint determines the treatment applied. Paints are composed of some vehicle and a pigment; the vehicle hardens or sets by the evaporation of some volatile ingredient or by the absorption of oxygen from the air, depending upon its chemical nature. The pigment can be removed mechanically after the vehicle carrying it is dissolved again.

"*Perspiration.*—This stain, being water borne, is usually removed by simple soap and water washing. If it is connected with the running of a dye, treatment for the dye must be applied. Colored goods that have been discolored by perspiration may sometimes be restored by sponging with weak acid or alkaline solutions.

"*Scorch.*—Scorched cotton or linen may be restored by treatment with Javelle water alternated with oxalic-acid solution, provided the scorch has not completely destroyed some of the fabric. The same results may also be obtained with potassium permanganate and sodium bisulphite solutions. Light scorches on silk and wool may be partially restored by treatment with permanganate solution, but nothing can be done for heavy scorches on these fabrics.

"*Sirup.*—Sirup stains are usually removed in the standard washing process, because the medium of the stain, the sugar, is removed. If a fruit juice has been present, some stain may survive this process, but the treatment described under Fruit will remove it satisfactorily.

"*Tar and tarry.*—See treatment of paint.

"*Tea.*—Tea stains are usually removed in the washing process, but the occasional heavy one should be treated with Javelle water when it appears on cotton and linen and with potassium permanganate or hydrogen dioxide when it appears on silk or wool. This

stain is in most cases the result of the tannin present in the tea, but in some cases is due to a dye that is added to give a darker color to the infusion.

"*Tobacco.*—The stains from tobacco are usually soluble in the standard washing process, but occasionally stains that require longer treatment are encountered. They may be treated with the oxidizing agents that are permissible with the type of fabric involved or they may, in case of the tarry residue from pipes, be treated with ethyl alcohol.

"*Tumeric.*—This is one of the seven dyes permitted by the United States pure-food law to be used in foodstuffs. Tumeric stains are usually to be removed by treatment with Javelle water or permanganate solution, but in cases that do not respond to this treatment amyl alcohol will be found effective.

"*Verdigris or copper stains.*—This stain, if not removed by the usual laundry process, has to be treated quite drastically with dilute hydrochloric acid. If only a weak solution of acid is used and care is taken to remove all traces of it afterwards, no ill results will be noticed.

"*Walnut.*—This stain is one of the worst encountered on fabrics. It can usually be reduced to a light gray color on cotton and linen by treatment with Javelle water, but when on silk and wool no treatment can be recommended.

"*Wax.*—The most satisfactory method of removing waxes from fabrics is to place the spot on a piece of blotting paper and apply a warm iron. The heat liquefies the wax and the blotting paper absorbs it. If traces remain after this treatment, they may be sponged away with one of the organic solvents."

In conclusion it is appropriate to suggest that inspection of garments for stains be rigidly maintained in the receivng room. Many times stains are set in laundering, and offer a greater problem for removal than they otherwise would.

OREGON BALSAM.*

By E. M. Holmes, F. L. S.

The oleoresin known in commerce under this name has for many years past taken the place of Canada balsam to a more or less extent. So far as can be gathered from various records, the earliest mention of its being substituted for Canada balsam was in 1872-1873, when there was a scarcity of the latter (*Proc. Amer. Ph. Assoc.*, 1873, p. 1192; 1874, p. 423). This statement is quoted in "Pharmacographia," second edition, page 615, but no indication of its botanical source is given, nor any means of distinguishing the two balsams.

In August, 1913, we learn from the *Journal of the American Pharmaceutical Association*, page 982, that "considerable difficulty has been experienced in the past year or two in obtaining Canada balsam of fir." It is stated that "it was then practically unobtainable, and that there would be none available till the next crop be gathered. In view of this fact it has become necessary to find a suitable substitute. Accordingly, there is considerable Oregon balsam of fir being offered to the trade. This is an allied natural product, and bears a close resemblance to the better-known Canada balsam of fir." At that date, information concerning Oregon balsam of fir was so meagre that Messrs. J. G. Roberts and M. M. Becker sought to obtain data for the identity and purity of this product, so as to distinguish it from Canada balsam, and obtained through Mr. R. G. Bailey a genuine sample of the Oregon balsam of fir for chemical examination. They found that it differed in its viscosity, being thinner than Canada balsam; in its solubility in alcohol, being completely soluble in it; whilst, according to the U. S. P., Canada balsam yields a turbid solution. Oregon balsam does not solidify even when mixed with 60 per cent. of its weight of moistened magnesium oxide, whilst Canada balsam should solidify when mixed with 20 per cent. of moistened magnesium oxide. Oregon balsam is also slower in drying; a drop spread on a glass plate was still sticky at the end of three weeks, while that of Canada balsam was noticeably drier, and did not adhere to the finger when touched.

*Reprinted from the *Pharm. Journ. and Pharmacist*, February, 1922.

The authors conclude that the acid number of Oregon balsam is the best means to establish the difference between it and Canada balsam, the acid number of which is 87. That of the genuine sample of Oregon balsam gave 111, and that of other commercial samples varied from 100.5, 100.8, 105.82, 106.75, but in every case was considerably higher than 87.

The botanical source of Oregon balsam is given in an article in the *American Journal of Pharmacy* (1919, p. 345) as *Pseudotsuga taxifolia*, by Mr. S. A. Mahoud, chemist in forest products, of the U. S. Food Products Laboratory, Madison, Wisconsin. He remarks that "it is probably employed to some extent in the place of Canada balsam." In February, 1919, the market price was given as $1.75 to $1.80 per gallon, the price having increased from $1.15 to $1.25, the increase in price being the result of increased domestic demands owing to the greater use of the Oregon balsam, particularly by the varnish trade, also as a substitute for Venice turpentine, particularly in the ceramics industry and in the manufacture of porous plasters.

An interesting account of the method of obtaining the Oregon balsam is given by Mr. Mahoud. The oleoresin collects in cavities in the tree in pockets, produced especially in wind-shaken trees (probably by the wind bending the trunk). These pockets in time fill with oleoresin, and if an aperture is made it readily flows out. Trees containing such pockets are spotted by collectors, who bore holes into them (being probably guided by the one-sided trend of the branches so readily observed in trees in wind-swept places in this country). From the holes bored into the trunk one to three gallons is frequently obtained from a single boring. It is suggested by Mr. Mahoud that the method adopted in Europe of making artificial pockets in the larch in the spring in mature trees about forty inches in girth would probably yield a more certain harvest if applied to the Oregon fir, *Pseudotsuga taxifolia*. These cavities extend to the centre of the larch at about a foot from the ground, and, when made, the holes, about 1½ inches in diameter, are plugged with a dry larch plug to prevent loss, the cavities being emptied in the autumn by an auger. In the case of the larch, the tree is but little injured, and is said to yield oleoresin for twenty-one to fifty years (Tschirsch, "Die Harze und die Harzbehalter," 1906, p. 614, and G. Planchon and E. Collin, "Les Drogues Simples," 1, p. 70). As

the cost of the Oregon fir balsam is about one-sixth the cost of that of Canada balsam, it will probably replace the latter for many purposes, except that of microscopical work.

From an article by Prof. Augustin Henry on the Douglas fir, it will be noticed that he uses the synonym *Pseudotsuga Douglasii* for the tree which Mr. Mahoud calls *P. taxifolia.* This tree, which has recently been recommended by Prof. Henry for cultivation in suitable localities in Britain and British Dominions, since it is a rapid grower, forms excellent timber and yields a quantity of oleoresin, and it is evidently worthy of the serious attention of forest officers. In British Columbia one firm has already established a plant to treat ten barrels per day of the oleoresin.

Canada balsam is collected in such a different manner and in so much smaller quantity, and the collection is so little explained in most text-books of materia medica, that it may be interesting to recall some of the details published more than forty years ago in the Report of the Committee on the Drug Market to the American Pharmaceutical Association at its meeting at Toronto (*P. J.*, April 13, 1878, p. 813).

Canada balsam is largely collected in the province of Quebec. Mr. W. G. Brund, chemist, of Quebec, at that date, states as follows: "The whole family of balsam gatherers go into the woods in the Laurentine Mountains at a distance of from seven to ten miles from the villages. There they encamp for two months. The mother remains in the camp to do the cooking and to strain the balsam, and it is she who transports it in canisters of five gallons each, on her back to the villages, where she sells it at the rate of one dollar twenty cents a gallon in exchange for flour and pork, which she carries back to the camp. The father, with the boys, goes to pierce the trees, each furnished with a small can, with a tube proceeding from it at the top. The tube is of iron, sharpened, and with this portion of the instrument the blisters containing the oleoresin are pierced one by one, the liquid flowing down the tube till the vessel is full. (These blisters occur separately under the corky layer of the bark, the oleoresin not forming pockets in the wood, as in *Pseudotsuga Douglasii.*) The children mount the branches, whilst the father works on the lower part or trunk of the tree. A large tree will yield only about 1 pound of oleoresin, but on the average, the amount per tree is only about 8 ounces. A

father with two children may be able to collect a gallon of oleoresin between sunrise and sunset, but a man working alone has done a good day's work if he collects half a gallon. The 'balsam' cannot be collected when it rains, for the water dripping from the branches and running down the trunk renders it milky and unsaleable. The collection is made between June 15 and August 15 or September 1, when the snow usually begins to fall, and the balsam no longer flows. It is only the poorest inhabitants and the Indians who do this business. The largest crop ever gathered in one year was 5000 gallons. The trees should not be pierced two years running, and it requires two or three years before the second tapping, and then it aways yields much less than the first time." It will be readily understood, therefore, that Canada balsam, if genuine, must be much more expensive than Oregon balsam.

THE SCIENCE OF LIFE AND OF DEATH.*

It was a great saying of the celebrated Dutch-Jew philosopher Spinoza that "The free man thinks of nothing so little as of death; his meditation is not on death, but on life." The free man in Spinoza's sense is still a rare specimen of *Homo Sapiens*, so that for the mass of mankind death has not been robbed of its terrors, and, save for the young, to whom it seems a remote contingency, it is an ever-present shadow even in the brightest scenes of life. It is doubtless true, as Shakespeare tells us, that

> "The fear of death is most in apprehension.
> A beetle feels a corporal pang as great
> As when a giant dies."

But this philosophy affords little relief to the average human being, and even the teaching of Montaigne, that most sagacious of essayists, who in his essay on "Death" assures his readers that man passes out of life as painlessly and unknowingly as he enters it, or as he sinks into slumber when tired out at the end of the day's work, is not convincing. Modern thought demands something more positive than those consolations of philosophy which presuppose a philosophic capacity of which ordinary persons are destitute. Hence

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the appeal to science for a *rationale* of life and death. Until recently scientific research had failed to shed much light on what a certain school still characterizes as the "mystery of life," but the once fiercely agitated controversies between the Vitalists and the Abiogenesists have no real significance now, when bio-chemistry has revealed so much of the mechanism of living matter. There is always a point at which any explanation of natural phenomena ceases to explain, because the human mind cannot reach beyond ultimate reality. Short of this there is no "mystery" that science is not capable of elucidating. The study of the mechanism of living matter has been remarkably facilitated by the microbiological research and discovery with which the immortal names of Pasteur, Lister, and Metchnikoff must always be identified, and it is to Metchnikoff especially that we are indebted for the inspiring conception of the living organism as a battleground of opposing forces, namely, the conservative factors, in the form of the digestive cells or phagocytes, which are present in all living things from the most primitive up to the most highly developed species, and the microbic or toxic enemies to bioplasm, with which the phagocytes wage perpetual defensive warfare. As Metchnikoff and some of his predecessors proved, many protista and protozoa, which reproduce by the splitting up of the individual into two or more new individuals, are, strictly speaking, physically immortal; as in the process of division or subdivision it is impossible to say which is the older organism. For such species, therefore, there is no natural death, although there must often be accidental or catastrophic extinction of individuals. The hereditary substance, or germ-plasm of Weissman, is in the higher animals, the homologue of the unicellular immortals, but in this case the somatic or body substance of the individual perishes, and the personality passes, since the offspring are a mixed product of the inherited characters of parents, grandparents, or remoter ancestors. For the vast majority of species of metazoa, life is merely a trust for the benefit of posterity, so that the individual is of value only as a transmitter of the so-called life-force which Bernard Shaw has made the *primum mobile* of a new religion. One of Metchnikoff's most memorable researches had as its object the definite ascertainment of the causes of the "disharmonies" which shorten what he believed to be the normal duration of human life, and as readers of his work on "The Prolongation of Human Life" will

remember, he formulated the theory that human beings are aged prematurely, and many of them die before their natural term, because of the presence in the "intestinal flora" of toxin-producing bacteria, the products of which (phenols and indols) are absorbed into the blood-stream in such quantities and so constantly that the phagocytes are unable to cope with them, and tissue-degeneration sets in, the cells of the degenerate tissues in their turn being devoured by the phagocytes. Metchnikoff was at first confident that the introduction into the intestine, by means of food, of *lacto-bacilli,* and *Glycobacter peptonicus,* would inhibit the action of the putrefactive bacteria, and there can be no question whatever but that the sour-milk diet has proved most beneficial in many cases of intestinal indigestion, but, as Metchnikoff admitted later, the problem is a complicated one, and much more will have to be learned about the nature and action of the "intestinal flora" before a scientifically hygienic dietary can be devised. But if this can be done and other life-shortening conditions eliminated, we share Metchnikoff's optimism in anticipating that most microbe diseases can be prevented, if not entirely extirpated, so that in many cases death will come about naturally, as a result of the gradual ebbing of the sensorial and other activities which collectively constitute life. In this connection Metchnikoff sought to discover demonstrative examples of "natural death." The Ephemeridæ, or May flies, which are unable to feed themselves, were, as the name implies, too short-lived to enable him to determine to what precise cause their death was due, and the Rotiferæ, which also lack buccal organs, and cannot therefore take in food, were too small in size for physiological experiments, but in the case of the silk-moth, which was favorable for experimental purposes, Metchnikoff discovered that it was not hunger that caused death, since the moth subsists on the fatty substance which remains after the metamorphosis of the chrysalis into a moth, nor were there any indications of exhaustion, or of the presence of micro-organisms which might have caused death by infection. Metchnikoff was haunted by some misgiving on the latter point, as he suspected that microbes invisible even under the highest-power microscope might occur. But, apart from this reservation, the silk-moth seems to furnish an example of "natural death" such as, under appropriate hygienic conditions, might be vouchsafed to man. The problems as to the "instinct of life" or self-preservation,

and the "instinct of death" or what ought to be a natural desire for death, are psychological, but have a physiological basis. According to Metchnikoff, the desire or will to live is not so strong in the young as in persons of maturer years, but we are disposed to regard this as a personal view, rather than a sound generalization. Metchnikoff's early life and his scientific career as a young man in Russia, were embittered by perpetual struggle, and frequent disappointment. Later, in the congenial and inspiring environment of the Pasteur Institute, the pessimism begot of privation and frustration of effort, mellowed into a sane optimism with a keen zest for life, and the pursuit of science for the benefit of mankind. The outbreak of the world-war in 1914 was a shattering blow to Metchnikoff's faith in the stability and progress of civilization, but his optimism survived it, and after a torturing illness, he died firm in the persuasion that one day science will succeed in delivering humanity from the scourge of diseases, chiefly through prophylaxis and rational hygiene, and that there will also be a new science, the science of death, which will make it less hard to die. For in the case of human beings who survive to an advanced age, free from disease, and suffering only from slow progressive enfeeblement of body and of mind, there is generally an "instinct of death." As the desire or will to live, and the interest in the advantages and pleasures that life has to offer lessen in force, the desire for the rest that death alone can give grows stronger, until the gently worn-out soul chants gladly its "Nunc dimittis." Far better this euthanasia than the agonies of death, which often make dissolution so terrible, even when it is prayed for by the victim and the witnesses of his or her torments. May this deliverance be the last and the greatest of the gifts of Science to mankind!

REPORT OF THE ONE HUNDRED AND FIRST ANNUAL MEETING OF THE PHILADELPHIA COLLEGE OF PHARMACY AND SCIENCE.

The annual meeting of the Philadelphia College of Pharmacy and Science was held in the Museum of the College on March 27, 1922, President Braisted in the chair.

Forty-six of the members present signed the roll, although the attendance numbered about sixty-five.

The minutes of the quarterly meeting, held December 27, 1921, were approved as read.

Under the head of unfinished business the resignation of Dr. R. P. Fischelis from membership on the Publication Committee was presented and upon motion of Mr. Peacock was accepted with expressions of regret that pressure of other duties prevented Dr. Fischelis from continuing as a member of this committee.

Mr. J. W. England, Chairman of the Special Committee on Constitution and By-Laws, presented the revision, which is printed elsewhere in this issue.

Affirmative action was taken upon each paragraph as read and a motion of Mr. England to adopt as a whole was unanimously carried.

Prof. F. P. Stroup in presenting the report of the Committee on College Membership stated that about six hundred new names had been added to the list of college members. The report, upon motion, was received.

No report was made by the Committee on Necrology.

The Committee on Publication of the AMERICAN JOURNAL OF PHARMACY in its report directed attention to the increased cost of publication incurred by the large increase in College membership and recommended an increase of $100 per month in the College appropriation for the use of this committee. The report was received and upon motion of Prof. LaWall the recommendation for an increase in the College appropriation was referred to the Finance Committee of the Board of Trustees for favorable action.

The Committee on Founder's Day Celebration, Prof. LaWall, chairman, reported that the celebration was held according to the proposed plan and was fairly successful as to attendance and very successful as to program and enthusiasm aroused.

A Special Committee on Future College Programme, Mr. B. T. Fairchild, chairman, presented the following report for the Board of Trustees:

"Gentlemen:

"Your Committee appointed, pursuant to Resolution of March 7, to prepare a statement of the development plan for the College, begs to submit the following report:

"A survey of the problems involved discloses three major topics which demand careful consideration as follows:

"First. The continuance and development of present facilities.

"Second. The determination of a permanent location.

"Third. Our possible contribution as a nucleus for the development of a National Institute of Pharmacological and Therapeutic Research, Practice and Teaching.

"The Committee wishes to call attention to plans formerly prepared by the Centennial Committee, under which it was intended to raise a substantial fund for the construction of modern buildings, etc.

"It is believed that the contract with Will, Folsom and Smith should be extended with a view to carrying on the drive for funds.

"We think it should also be noted that the final decision as to the location of the Delaware River Bridge will enhance the value and marketability of our present holdings and will adversely affect the character of this section of the city for our purposes.

"The Committee is especially impressed with the opportunity for co-operation whilst maintaining the independent integrity of our Institution, and feels strongly disposed toward recommending transferrence of its activities into a closer physical proximity to some larger educational institution whose courses may be exchanged or purchased by our institution from the other, thus enhancing and enlarging the opportunities of each.

"In reaching this opinion the Committee has been impressed by the danger to pharmacy of what is in effect detached vocational training, and by the benefits which would obtain if arrangements could be made under which medical students could come into closer contact with and a finer appreciation of the contribution to public health of which the pharmaceutical sciences are capable.

"Again in considering the possibility of the early establishment of a National Institute, your Committee has leaned strongly toward a location with adequate grounds for such an institute. Even without reference to the establishment of such a national institute our facilities should be very substantially increased. In fact, your Committee is advised that extension is needed at home for taking care of our higher classes, and we are confronted with the necessity of providing a new laboratory and a new class room for next year's work.

"The Committee is of the opinion that as soon as the College has made adequate provision for the continuation of its scholastic work, it would constitute the ideal 'central figure or activating agent' for the launching of the plants for the National Institute as proposed by Admiral Braisted.

"In conclusion the Committee's recommendations are as follows:

"First. That for the present, only such minor changes and additions be made in our present buildings as to satisfy the requirements of our existing courses. That the Faculty be immediately re-

quested to furnish the officers with recommendations for necessary changes within the next two years as far as they can be forecast at present.

"Second. That where possible a co-operative relationship with an institution that might be helpful be considered, and a site selected that will aid by proximity.

"Third. That at the proper time the campaign for the raising of funds shall be completed with the idea for providing for site, building and an endowment fund.

"Fourth. That a qualified committee be appointed at an early date to carry on the preliminary surveys and to formulate the necessary plans looking toward the establishment of a national institute, the idea in which our College has taken the initiative and in the realization of which it shall be essentially associated or the nucleus.

"Signed by

"B. T. Fairchild (per C. H. LaWall),
"Charles H. LaWall,
"Samuel P. Wetherill, Jr.,
"W. C. Braisted."

Upon motion of Prof. LaWall, seconded by Mr. Rohrman, the meeting unanimously approved the recommendations included in the report and urged the College officers and the Board of Trustees to take such steps as would meet in their opinion the requirements of the report.

President Braisted, in his annual report, gave a comprehensive review of the work accomplished during the first year of the second century of the existence of the College and stated that the outlook for the future was encouraging. Upon motion of Mr. Osterlund, the report was received and referred to the Publication Committee. The following abstracts from the interesting address call special attention to important phases of College program and progress:

"The closing of another year of our College history, the first of the new century, offers an opportunity for a brief review of its accomplishments and our plans.

"Coming to you about a year ago with an appreciation of the value of the profession of pharmacy through my experience in the navy, but without an intimate personal knowledge of the needs of pharmacy in general, it has been necessary to make a comprehensive study of the situation. An earnest effort has been made throughout the year to obtain the viewpoint of every division of pharmacy, and it is from this sympathetic background that plans are being made for the future.

"With a realization that under the most favorable circumstances it would be several years before new buildings and equipment could be provided for the College, attention was immediately given to the physical condition of the College property. Through the generosity of members of the Board of Trustees and friends, it was possible last summer to make many urgently needed repairs and improvements; so that upon the opening of the course last fall the physical condition of the present buildings was very much improved.

"On the educational side, the new Bachelor of Science courses were launched, with additions to the faculty to take care of the Language and Science courses, and additional assistants (nine in number), were also provided for the Laboratories, and several other departments, thus materially strengthening the teaching work.

"The entering class in September was large, almost 350, the total number of students registered for the Ph. G. course being 640. There were ninety-eight additional students registered for advanced courses, so that the facilities of the College were being used almost to their capacity.

"The large number of students already enrolled in the advanced courses compels the immediate consideration of our plans for new buildings and equipment and your Board of Trustees will place recommendations before you on this subject, representing the result of a year's careful study.

"During the autumn of 1921, through the generosity of the H. K. Mulford Co. the use of about 2½ acres of ground was acquired by the College near Glenolden, Pa., for the establishment of botanical gardens.

"Prof. Youngken was made director of these gardens and plans for their development are well under way.

"Ground was broken during October for the main garden and by early December twenty-eight beds and border beds were dug out and their borders sodded. The old Mulford Garden has been overhauled and with the completed main garden will contain plants arranged in beds according to families, which is in accordance with the scheme of botanical gardens connected with universities here and abroad.

"The year has been in many respects an unusual one, highly satisfactory in almost every way—with the expansion of our teaching staff and the gradual uplift for higher educational standards, the financial condition has been, and remains, fairly satisfactory. The introduction of a budget system has made for a safer and better conduct of affairs.

"The plans for the future seem reasonably bright, and it is hoped that not only may the teaching of pharmacy and its branches be vastly improved, but that the years to come will see this institution the centre of most important research work. The great demand today along these lines is for experimental therapy and the demand

is growing for some institution to take up this work. It is planned if possible to make the College, in addition to its strictly educational work, a centre or national institution of experimental and research therapeutic endeavor.

"It seems to me that our College should be the one institution to supply the need shown in this article, and the opportunity is ours now if we have the courage and strength to attempt it.

"For the future we seem to have determined the following things:

"1. The present site of the College must be changed for a better one—I think we are soon to have this site.

"2. That the effort to complete the raising of funds, for purchasing a new site, for building a new College and for endowment be actively pushed as soon as the time is considered propitious.

"3. The expansion of the College work to make it the leading institution in pharmacy and research work pertaining to therapeutics in this country.

"4. Co-operative union with the leading institutions of the city that wish our help and are willing to reciprocate to assist our needs.

"No more splendid opportunity could be presented to this institution than exists now—with every outlook for a successful undertaking and with the plans and resources being considered at the present time not alone by ourselves but by many powerful and interested factors that give every promise of completion within a few years.

"Let me urge you, therefore, to be awake to the progress of events in connection with the College and its future welfare, which seem to point to a career far beyond our most sanguine expectations."

Mr. Ivor Griffith, in the editor's annual report, pointed out that the number and quality of the contributions printed in the American Journal of Pharmacy during the past year indicated that it was well maintaining its record of past years in the world of scientific periodicals.

The report of the Curator, Prof. H. W. Youngken, referred to the refurbishing and improved arrangement of the Museum and its contents, and bespoke the co-operation of members and friends of the College in building up a representative zoological collection, the most needed specimens including taxidermic mounts of birds and mammals and a good collection of insects and skeleta of vertebrates. The Curator acknowledged the receipt of forty-eight slides and case from the Pharmacy Department and three thousand shells of molluscs, presented by Dr. Githens.

Prof. Youngken reported the botanical gardens as being in good shape and acknowledged the receipt of a specimen of leprosy plant from the Bureau of Plant Industry at Washington.

The Librarian, Prof. F. P. Stroup, reported over one hundred accessions to the Library during the year, as well as the receipt of numerous publications issued by the various departments of the U. S. Government. Frequent use was made of the Library by students, Faculty, and the general public, and under the rules of the Inter-Library Loan, books and periodicals were sent to the U. S. Government, industrial establishments and various schools of pharmacy.

Mr. O. W. Osterlund, for the Legislative Committee, reported participation in a conference held in Washington, which was called to oppose the principle of releasing tax free pre-medicated alcohol for use in the manufacture of pharmaceutical preparations intended for internal use. On behalf for the College, the Legislative Committee opposed the plan, whether permissive or mandatory.

Mr. J. C. Peacock, in the absence of Mr. Thum, chairman of the Nominating Committee, presented the following report:

"March 13, 1922.

"To the Secretary of the Philadelphia College of Pharmacy and Science, Philadelphia, Pennsylvania.

"Dear Sir:

"In accordance with the By-Laws, the Committee on Nominations submits the following list of nominees, to be acted upon at the annual meeting, March 27, 1922.

President, William C. Braisted
First Vice President, Frank R. Rohrman
Second Vice President, Joseph L. Lemberger
Treasurer, Milton Campbell
Corresponding Secretary, Adolph W. Miller
Recording Secretary, Ambrose Hunsberger
Curator, Heber W. Youngken
Editor, Ivor Griffith
Librarian, Freeman P. Stroup

Trustees (four to be elected)

William D. Robinson
R. S. Sherwin
F. P. Streeper
Paul Kind

Publication Committee

Charles H. LaWall
Joseph W. England
John K. Thum
Heber Youngken
Julius Sturmer
E. Fullerton Cook

Committee on Pharmaceutical Meetings

Clement B. Lowe
Richard H. Lackey
Charles H. LaWall
John K. Thum
Heber W. Youngken

"(Signed)
"JOHN K. THUM, Chairman."

Mr. J. W. England stated that inasmuch as there was only one name placed in nomination for each office to be filled, he would, therefore, move that the Secretary be instructed to cast a ballot electing to the respective offices the nominees selected by the Nominating Committe. Seconded and unanimously carried. Mr. England then moved that the Secretary be instructed to cast a bollot electing to the Board of Trustees the nominees selected by the Nominating Committee. Seconded and unanimously carried.

Mr. Wetherill then moved that the Secretary be instructed to cast an unanimous ballot electing all the nominees. Seconded and unanimously carried.

Complying with these instructions, the Secretary cast a ballot for the complete list of nominees selected by the Nominating Committee, and the President thereupon declared them unanimously elected to the respective offices and membership upon the Board of Trustees—the officers to serve for one year and the members of the Board of Trustees each to serve three years.

Prof. E. Fullerton Cook presented resolutions endorsing the Sesqui-Centennial Celebration to be held in Philadelphia in 1926. Mr. S. P. Wetherill, Jr., moved that a committee with power to adopt be appointed to redraft the resolutions. This was seconded by Prof. Cook and carried.

The president appointed on this committee Messrs. Wetherill, Cook, LaWall, England and Dr. Robinson. This committee prepared and adopted the following resolutions:

WHEREAS, the spiritual, social and material progress achieved during the past one hundred and fifty years is in a large measure traceable to the religious, political and economic freedom consequent upon the signing of the Declaration of Independence; and

WHEREAS, the sacrifice not only of our men ancestors but those fired with zeal for human progress throughout the world have paved the way for a world-wide realization of the blessings which must result from the practice of these high principles; and

WHEREAS, it is believed that a more general understanding of the fundamental principles postulated in the Declaration of Independence will contribute toward the solution of present day world problems and stimulate untold creative possibilities toward world peace and co-operation.

NOW, THEREFORE, BE IT RESOLVED

That the Philadelphia College of Pharmacy and Science, founded in the City of Philadelphia One Hundred and One years ago, pledge to the City of Philadelphia, the Commonwealth of Pennsylvania, and the Nation, its full co-operation in any and every way possible to assist in the movement for a Sesqui-Centennial Exhibition; and

That the Trustees, Faculty and members of the Alumni Association, no matter where they be located throughout the world, pledge themselves individually and collectively to do anything in their power to bring to the City in Philadelphia, in 1926, the leading representatives of our profession; so that the world at large may profit by their conferences, exhibits and teachings; and

That a copy of this resolution be sent to the Mayor of the City of Philadelphia, Chairman of the Sesqui-Centennial Exhibition Association, and also be printed in the American Journal of Pharmacy for the benefit of all interested in Pharmacy.

Meeting adjourned.

AMBROSE HUNSBERGER,
Recording Secretary.

CONSTITUTION AND BY-LAWS OF PHILADELPHIA COLLEGE OF PHARMACY AND SCIENCE.

Adopted March 27, 1922.

CONSTITUTION.

ARTICLE I.

Name.

The name of the Corporation shall be the Philadelphia College of Pharmacy and Science as incorporated by Act of the Commonwealth of Pennsylvania approved March 30, 1822, and subsequently amended by decrees of the Court of Common Pleas No. 1 for the County of Philadelphia, and recorded on September 2, 1878, as the Philadelphia College of Pharmacy, and on May 5, 1920, as the Philadelphia College of Pharmacy and Science.

ARTICLE II.

Objects.

The objects of the Corporation shall be the advancement of Pharmacy and allied Sciences, and the promotion of correlated education and research.

ARTICLE III.

Members.

The College shall consist of Active Members, Corporation Members, Corresponding Members, and Honorary Members.

ARTICLE IV.

Officers and Manner of Election.

The officers of the College shall be a President, two Vice-Presidents, a Recording Secretary, a Corresponding Secretary, and a Treasurer, and their respective duties shall be assigned by the By-Laws.

The officers shall be elected annually at the stated meeting of the College in March, and any vacancy that may occur may be filled for the unexpired term by a special election held at the next stated meeting after the occurrence of such vacancy.

A Librarian, a Curator, and an Editor, shall be elected annually, also, at the stated meeting of the College in March, and any vacancy

that may occur may be filled for the unexpired term by a special election held at the next stated meeting after the occurrence of such vacancy.

ARTICLE V.

Board of Trustees.

The Board of Trustees of the College shall consist of twenty-four members, four of whom shall be elected each year at the stated meeting of the College in March, and four at the stated meeting of the College in September, for terms of three years each, and their duties shall be assigned by the By-Laws.

Any vacancy that may occur in the Board of Trustees may be filled for the unexpired term at any regular election of the College after such vacancy shall occur.

The President, the two Vice-Presidents, the Recording Secretary, the Corresponding Secretary, and the Treasurer, shall be *ex-officio* members of the Board of Trustees.

Thirteen members of the Board of Trustees shall constitute a quorum.

ARTICLE VI.

Business.

The right of voting or holding office and transacting business shall be vested solely with the active members.

ARTICLE VII.

Seal.

The College shall have a common seal.

ARTICLE VIII.

By-Laws and Rules.

The College may establish such By-Laws for its government and regulation as may be deemed necessary and proper.

By-Laws of the College.

ARTICLE I.

President and Vice-President.

Section 1. The President, or in his absence, one of the Vice-Presidents, or in their absence, a president *pro tempore*, shall occupy

the chair at the meetings of the College, enforce the by-laws or rules, preserve order, and shall give the casting vote when necessary.

Sec. 2. He shall call a special meeting of the College at the request of any three members in writing, specifying the object of the meeting.

Sec. 3. He shall appoint all committees, unless otherwise provided for by the By-Laws; and shall sign the diplomas and certificates of the College.

Sec. 4. He shall confer the degrees at the annual Commencement of the College.

ARTICLE II.

Recording Secretary.

Section 1. The Recording Secretary shall keep correct minutes of the proceedings of the College, and preserve all documents belonging thereto that may come into his possession.

Sec. 2. He shall keep a correct list of the members of the College, with the dates of their election, resignation or death.

Sec. 3. He shall issue the notices for the meetings of the College at least one day previous to the time, and furnish the chairmen of all committees with a copy of the minute of their appointment.

Sec. 4. He shall prepare the minutes for publication in the AMERICAN JOURNAL OF PHARMACY, and by his signature attest the diplomas and certificates of the College.

ARTICLE III.

Corresponding Secretary.

Section 1. The Corresponding Secretary shall conduct and preserve the correspondence of the College with corresponding and honorary members, and scientific individuals and societies. It shall be his duty to reply to all such communications addressed to or regarding the College. He shall first submit such correspondence to the President for his approval, and the records thereof shall be presented at the stated meetings of the College.

ARTICLE IV.

Treasurer.

Section 1. The Treasurer shall receive and take charge of the funds of the College, and shall be bonded at the expense of the

College for the faithful performance of this trust. He shall supervise the issuing of all diplomas and certificates of the College; shall have the custody of the seal, and affix the same under direction of the College or the Board of Trustees.

Sec. 2. He shall collect all money due the College, and shall pay no money except on an order of the President, or the Chairman of the Board of Trustees, countersigned by the respective Secretaries of the College or Board, as the case may be.

Sec. 3. He shall present an annual report to the Board of Trustees at the stated meeting in September.

ARTICLE V.

Librarian.

Section 1. The Librarian, under the direction of the Committee on Library of the Board of Trustees, shall have charge of the Library, and shall present an annual report to the College at the stated meeting in March.

ARTICLE VI.

Curator.

Section 1. The Curator, under the direction of the Committee on Museum of the Board of Trustees, shall have charge of the Museum and Herbarium, and shall present an annual report to the College at the stated meeting in March.

ARTICLE VII.

Journal.

Section 1. There shall be published monthly a Journal to be called the AMERICAN JOURNAL OF PHARMACY, the issuance of which shall be under the direction of a standing committee of seven members, of whom the Editor shall be one, elected annually at the stated meeting in March, and known as the Committee on Publication.

Sec. 2. The Journal shall contain original papers, selections from scientific periodicals and books, editorials, reviews, transactions of the College and Board of Trustees, and such other matter as the Committee on Publication may deem desirable to publish.

Sec. 3. The Committee on Publication shall fix the subscription price of the Journal and the salary of the Editor, subject to approval by the College; shall employ necessary assistance; shall

keep an accurate account of all receipts and expenditures, and of stock on hand; shall adopt rules and regulations for the proper and successful management of the Journal, and shall present an annual report to the College at the stated meeting in March.

ARTICLE VIII.

Members and Committees.

Section 1. Any person approving the objects of the College as expressed in the Constitution, may be elected an Active Member.

Sec. 2. Any candidate for active membership must be proposed, in writing, by two members at a stated meeting of the Board of Trustees, and may be balloted for at the next stated meeting, and upon receiving the vote of two-thirds of those members present shall become a member of the College. If any proposed candidate for membership be defeated, the name of such candidate shall not be recorded in the minutes.

Sec. 3. Active members shall pay five dollars annually, in advance, from the date of election. After twenty-five payments of five dollars, the member shall become a Life member and the annual dues shall cease.

Sec. 4. Any Active member, or applicant for Active membership, who shall pay the sum of seventy-five dollars at one time, may be elected a Life member, and be exempt from all further payments of dues; and all such payments may be kept in a separate fund if desired, from which may be taken annually for the current expenses of the College, the sum of five dollars for each Life membership.

Sec. 5. Any firm, corporation or association approving the objects of the College as expressed in the Constitution, may be elected a Corporation member. Corporation members shall pay ten dollars annually in advance from the date of election.

A Corporation member shall have all the privileges of active membership, including the right of participation in the meetings and work of the College through a representative appointed by the firm, corporation or association, but shall have no right to vote or hold office; this shall not debar, however, any employee or member of a firm, corporation or association from individual membership and privileges.

Sec. 6. Any Active or Corporation member neglecting to pay the annual dues for two years after they are due, shall forfeit the

right of membership; reinstatement may be had upon reapplication and the payment of arrearages.

Sec. 7. No resignation shall be received from any Active member or Corporation member unless it be accompanied by a statement from the Treasurer that all arrearages have been paid and any certificate of membership issued has been returned or destroyed.

Sec. 8. Any person approving the objects of the College as expressed in the Constitution, and residing beyond the limits of the United States and dependencies, and of knowledge, skill and integrity, may be elected a Corresponding member of the College.

Sec. 9. No person residing in the United States or dependency shall be chosen a Corresponding member, nor shall any Corresponding member continue such after he or she has removed to and become a permanent resident of the United States or dependency, but may be elected an Active member upon application and the payment of the annual dues.

Sec. 10. Any person whose achievements in Pharmacy and Allied Sciences merit special recognition, may be elected an Honorary member of the College.

Sec. 11. All members shall be entitled to receive THE AMERICAN JOURNAL OF PHARMACY free of charge, unless one year in arrears for dues.

Sec. 12. All members shall have free access to the Library and Museum, subject to the rules and regulations governing the use of such departments.

Sec. 13. Corresponding and Honorary members shall have all the privileges of active membership, but shall be exempt from the payment of annual dues, and shall have no right to vote or hold office.

Sec. 14. Any member on paying five dollars shall be entitled to a certificate of membership, signed by the proper officers and sealed with the seal of the College; such member covenanting in writing to return said certificate to the College on ceasing to be a member.

Sec. 15. A member may be expelled from the College for sufficient cause, by a vote of three-fourths of the Active members present at a stated or special meeting, notice of the intention of the College to consider the subject of the expulsion of the member having been given at a previous meeting, but no member shall be expelled without having been notified and afforded the opportunity of being heard.

Sec. 16. A Committee on Necrology, consisting of three members, shall be appointed at the stated meeting in March, whose duty it shall be to report the deaths of members of the College with appropriate biographical notices.

Sec. 17. A Committee on Nominations shall be appointed annually at the stated meeting in March. This committee shall consist of five members, but not more than two of these shall be members of the Board of Trustees, and no member shall serve on this committee for more than two years consecutively.

It shall be the duty of this committee to report to the College at the semi-annual meetings, one or more names for each office to be filled, including Trustees. The Committee shall send to the Recording Secretary, at least two weeks prior to the date of the election, a list of the proposed nominations, and such list shall be sent to each member with the notice of the meeting.

Any five or more active members may propose a candidate or candidates by submitting to the Secretary, in writing, such proposition at least two weeks in advance of the meeting. All names so proposed are to be included in the list of nominations sent to members, and also, the names of the proposers.

In the event of the committee failing to submit nominations for any office the meeting shall nominate.

ARTICLE IX.

Board of Trustees.

Section 1. The Board of Trustees shall conduct the affairs of the College and make such By-Laws and Rules and Regulations, and do all such other proper acts as they may deem necessary for the government and support of the College, and also perform such duties as may be, from time to time, committed to them by the College, subject, however, to revisión by the College at each stated meeting.

Sec. 2. The Board shall meet once a month, or more often, if necessary, by adjournments or upon the call of the chairman.

Sec. 3. The Board shall appoint such standing committees as may be essential for the conduct of its work, and specify the duties of such committees in their By-Laws; and shall appoint such special committees as may be necessary.

Sec. 4. The Board shall be entrusted with the election of members as specified in Article VIII of these By-Laws.

Sec. 5. The minutes of the Board of Trustees, or abstracts of the same, shall be read at the meetings of the College for approval or correction; but the reading may be dispensed with by unanimous consent.

ARTICLE X.

Meetings.

Section 1. The stated meetings of the College for the transaction of business shall be held quarterly, on the last Monday of March, June, September and December. If the time of a stated meeting occurs on a legal holiday, the meeting shall be held on the day following, unless determined otherwise at the previous meeting.

Sec. 2. Fifteen Active members shall constitute a quorum.

Sec. 3. As soon as a quorum shall appear, at or after the appointed time of meeting, the President, or in his absence, one of the Vice-Presidents; or in their absence, a President *pro tempore,* shall take the chair and call the meeting to order.

Sec. 4. The order of business at stated meetings shall be:

1. Members present noted by Secretary.
2. Delegates present noted.
3. Minutes read, corrected if necessary, and approved.
4. Minutes or abstracts of minutes of Board of Trustees read.
5. Unfinished and deferred business.
6. Business from the minutes of Board of Trustees.
7. Reports of Committees.
8. New business.
9. Adjournment.

ARTICLE XI.

Certificates.

Section 1. The College shall grant certificates to every class of membership when desired; and in the case of honorary membership the certificates shall be issued without cost to the recipient.

Sec. 2. The preparation and issuance of all certificates shall be under the control and direction of the Board of Trustees of the College, and the certificates when issued shall be signed by the President and attested by the Secretary under the seal of the College.

ARTICLE XII.

Amendments.

Section 1. Every proposition to alter or amend these By-Laws shall be submitted in writing at one stated meeting, and may be balloted for at the next stated meeting, when, upon receiving the votes of two-thirds of the members present, it shall become part of the By-Laws.

ARTICLE XIII.

Rules or Order.

Section 1. On all points of order not noted in these By-Laws, the College is to be governed by the established usages of similar bodies.

SCIENTIFIC AND TECHNICAL ABSTRACTS

ABSTRACTS OF CERTAIN PAPERS READ BEFORE THE 1922 MEETING OF THE AMERICAN CHEMICAL SOCIETY.

THE FEEDING OF NON-KETOGENIC ODD-CARBON FATS TO DIABETIC PATIENTS. By Max Kahn.—It is prohibitive to feed diabetic patients who have a very low carbohydrate tolerance even a moderate amount of natural fat because of the danger of inducing a severe ketosis which may prove fatal It was found that synthetic non-ketogenic odd-carbon fats could be fed in large quantities to such persons without inducing any acidosis, and that the nutrition of such individuals was improved. A study is now being made of the intermediate metabolism of these fats and their effect on all types of diabetic and normal individuals.

A LABORATORY DISINFECTANT SOLUTION TO DISPLACE MERCURIC CHLORIDE. By Harper F. Zoller.—Sodium hypochlorite solution furnishes a means of providing an efficient, economical and safe sterilizing agent for use in biological laboratories. In the preparation of the solution it is essential to maintain a sufficiently high hydroxyl ion concentration for maximum stability—about pH 10.5.

Solution containing about 0.15 per cent. available chlorine (0.32 per cent. sodium hypochlorite) will destroy the most persistent of micro-organisms within ten minutes.

The Detection and Estimation of Inorganic Activators in Commercial Rennin and Pepsin Preparations. By Harper F. Zoller.—An activator-free pepsin or rennin solution coagulates dialyzed milk with great difficulty at the optimum temperature (41° C.) for rennin action. The presence of calcium or magnesium ions accelerates the enzyme action and gives the coagulum its normal physical consistency. The differential between the rate of coagulation in dialyzed milk and in undialyzed milk furnishes a factor, which, when compared with a similar factor obtained from activator-free enzyme solution under the same set of conditions, furnishes a means of roughly estimating the quantity of activator or accelerator present.

Influence of the Vitamine Content of a Feed on Immunity to Roup. By J. S. Hughes, L. D. Bushnell and L. F. Payne.—Chickens receiving a feed low in vitamine were much more susceptible to roup than those receiving a similar feed high in vitamines. Four pens, of twelve chickens each, received feeds varying in their vitamine content. One chicken from the pen receiving a feed high in vitamines, eight from the pen receiving a feed low in the fat-soluble vitamine, seven from the pen receiving a feed low in the water-soluble vitamine and nine from the pen receiving a feed low in both fat and water-soluble vitamine, died with clinical symptoms of roup or a disease similar to roup. All chickens were exposed to the roup infection by keeping infected chickens in the pens.

Cow's Milk Versus Goat's Milk as a Source of the Antiscorbutic Vitamine. By C. H. Hunt and A. R. Winter.—Four weeks before the experiment started two cows and three goats were placed on the same ration, consisting of equal parts of a grain mixture and alfalfa hay. Forty-four guinea pigs were divided into eleven lots of four each and were given a weighed daily amount of a basal ration consisting of rolled oats 69 parts, autoclaved alfalfa flour 25 parts, casein 5 parts and NaCl 1 part. All of the pigs received, with the exception of the control lot, in addition to the basal diet, a

measured amount of milk each day; one-half of the lots receiving cow's milk and the other half goat's milk. The amount of milk fed varied from 10-50 cc. in increments of 10 cc. The control lot died of scurvy in 26-30 days. The pigs receiving 10 cc. of cow's milk survived from 42-53 days, while the survival period of those receiving 10 cc. goat's was from 60-103 days. Up to a period of 90 days one death from scurvy occurred among the lot receiving 20 cc. Cow's milk, while no deaths from scurvy occurred among the pigs receiving 20 cc. goat's milk. There was a decline in weight of both lots receiving 20 cc. milk, but the decline was greater with those receiving cow's milk than with those receiving goat's milk. When the amount of milk fed daily was increased to 30 cc. or more no difference was noted between cow's and goat's milk as a source of the antiscorbutic vitamine (C).

Results Obtained by Feeding Breeding Gilts a Ration Low in Vitamine. By J. S. Hughes and H. B. Winchester.—Breeding gilts receiving a feed low in vitamin A and C developed no abnormalities during the first ten months. At this time they developed the eye trouble common to rats, rabbits, dogs and other experimental animals, and in addition to this they developed a nervous disorder manifested by a general inco-ordination accompanied by frequent convulsions. Two of the eight did not breed, two died during the latter part of the gestation period, two aborted a few days before they died, one farrowed dead pigs, and the last one has gone fourteen days longer than the normal gestation period. Gilts receiving five per cent. alfalfa as a source of their vitamine A showed no abnormalities. Five per cent. alfalfa did not furnish sufficient vitamine for normal reproduction as twenty-eight per cent. of the pigs farrowed by these sows were dead.

The Toxic Constituent of Greasewood (Sarcobatus Vermiculatus). By James F. Couch.—Greasewood is an important forage plant for sheep on the winter ranges in the west. It is common in the semi-arid, alkali valleys of the far western States, and, while it is extensively grazed, it has been found by Marsh, Clawson and Couch to be poisonous. Chemical examination of the edible portions of the plant showed that they contain a large proportion of oxalic acid and unusually large amounts of sodium and potassium salts.

Toxic alkaloids, glucosides, and saponins were absent and it was shown by experiments upon sheep that the poisoning is due to sodium and potassium oxalates. The leaves of the plant contain the largest proportion both of ash and of oxalic acid; in the stems most of the oxalic acid is combined as calcium oxalate.

Higher Alcohols Formed in the Fermentation of Sugar. By J. C. Swenarton and E. Emmet Reid.—Crude fusel oil, from the large scale fermentation of molasses with pure culture yeast, contains substances boiling above isoamyl alcohol even up to 270°. A quantity of the high boiling portion has been repeatedly fractioned in vacuum and the alcohol part of each fraction extracted by treatment with phtahlic anhydride. The alcohols obtained by saponification of the mono-alkyl phthalates boil up to 110° at 8 mm. and vary in density at 25° from 0.8007 to 0.9067. Some are optically active. They are being studied further with the hope of identifying the individual alcohols. The non-alcohol portions of the fractions boil up to 155° at 10 mm. and have densities at 25° from 0.80 to 0.90. Some are optically active.

Further Experiments on the Isolation of Vitamine. By Atherton Seidell.—The method as now used for the preparation of highly active vitamine fractions consists in heating fresh brewer's yeast mixed with water to about 90° c.; adsorbing the vitamine present in the filtered solution by means of English fuller's earth; extracting this latter with saturated barium hydroxide solution, and concentrating the extract after acidifying with sulfuric acid and filtering by rapid vacuum distillation.

More detailed experiments on the precipitation of the vitamine in these concentrated extracts by means of silver salts have shown that approximately one-third of the solids present unite with the silver salts to form insoluble silver compounds. About one-half of the total vitamine, as determined by feeding experiments on pigeons, is present in these insoluble silver precipitates and the other half remains in the filtrate. This unexpectedly large unprecipitable fraction of the vitamine raises the suspicion that the portion accompanying the silver precipitates may not be in chemical combination, but simply held by adsorption. Further studies of the silver precipitates and filtrates are in progress.

CORRESPONDENCE

EINBECK, THE BIRTHPLACE OF MORPHINE AND OF BOCK BEER.

Editor, A. J. Ph.

Sir: With much interest did I read your excellent editorial, "The Light in the Window at Einbeck" in the April A. J. Ph. Let us hope that it will act as an inspiration to pharmacists, especially the younger generation!

To my regret I notice that you use the old name *Eimbeck,* instead of the more correct name *Einbeck,* which was adopted when the village became a city in 1272. Einbeck is also the birthplace of the celebrated Bock Beer. This beer was first brewed in the fifteenth century and became known as "Einbeck Beer," which in time was simplified to "Bock Beer," a justifiable evolution, quite especially as *ein* (one) did not quite satisfy the thirst! In my address, "History of Beer" before the Long Island Drug Club at New York City, on March 17, 1913, I brought out this fact together with the statement that the great reformer, Martin Luther, was very fond of this Einbeck Bock Beer.

Now back from beer to morphine! Your editorial gives the wrong impression that Sertürner was proprietor of the apothecary shop at Einbeck. Friedrich Wilhelm Adam Sertürner learned pharmacy in the *Apotheke* at Paderbom, Westphalia, where he commenced his opium studies. In 1811 he became clerk in the apotheke in Einbeck, Hanover, where he continued his investigations. In 1820 he bought the apotheke in Hameln, where he died on February 20, 1841. In memory of the one hundredth anniversary of the discovery of morphine the Deutscher Apotheker Verein erected a tablet, properly inscribed, at the Hameln Apotheke.

Also permit me to call attention to the "miss" in your quotation of the award to Sertürner (last paragraph, page 220). The Institut de France, on June 27, 1831, after a thorough investigation, awarded the Monthyon Prix of 2000 francs to Sertürner "*pour avoir recomm la nature alcaline de la morphine et avoir ainsi ouvert une voie qui a produit de grandes déconvertes médicales.*" Wooton, in his excellent "Chronicles of Pharmacy," vol. II, p. 245, also omits

this very important statement, "*alkaline*," which won Sertürner the prize. Owing to the alkaline character of these plant bases the German apotheker Wilhelm Meissner, of Halle, coined the term "Alkaloid" in 1821.

I trust that you will pardon my "butting in" and will fully understand my motives, namely "More truth in pharmacy."

Respectfully,

OTTO RAUBENHEIMER, Ph. M.

Brooklyn, N. Y., April 19, 1922.

CORRECTION OF ERRONEOUS STATEMENT APPEARING IN MARCH ISSUE RELATIVE TO GOVERNMENT BULLETINS ON FRUIT FLAVORS.

Washington, D. C., April 4, 1922.

Prof. E. Fullerton Cook,
Philadelphia, Pennsylvania.

Dear Professor Cook:

In your interesting lecture as published in the March issue of the AMERICAN JOURNAL OF PHARMACY an incorrect statement has inadvertently been made which has given us considerable trouble. At the end of the article on page 167, after referring to the study of fruit flavors in the Bureau of Chemistry it was noted that "The results of this work is being published in a series of Government bulletins." No publications on this subject have either been issued or contemplated by the Government. You have doubtless had in mind the papers on the odorous constituents of the apple and the peach which were contributed by Power and Chestnut to the *Journal of the American Chemical Society* and published in the July, 1920, and July, 1921, issues respectively of that journal. As separates of such papers can only be procured at the expense of the authors they are not available for general distribution. A number of requests have already been received and many more may be expected for copies of Government bulletins on this subject and I would therefore be greatly obliged if you will kindly call attention in the JOURNAL to the error of statement.

Very truly yours,

FREDERICK B. POWER,
Pharmaceutical Research Chemist in charge,
Phytochemical Laboratory.

From the Scientific Section of the American Pharmaceutical Association.—Fellow-workers in Pharmacy: In order to obtain a census of scientific pharmaceutical research and to stimulate further work, the following recommendations were adopted by the Scientific Section at its last meeting.

1. To ascertain the nature and extent of scientific work carried on by pharmacists, completed in 1921, and now in progress.

2. To urge workers to carry on at least one piece of constructive work dealing with scientific pharmacy and publish the original or an abstract in the *Journal of the American Pharmaceutic Association.*

We cannot accomplish our task without the co-operation of those who are in a position to give it.

Should the splendid *Bibliography of Pharmaceutical Research,* published monthly, be incomplete in any particular, give us the missing data.

Indicate the general nature of your studies in progress, so that duplication of work will be avoided, the scientific activity of pharmacists be more fully recognized, and new research be suggested.

Do your part in solving at least one problem connected with pharmaceutical research.

Prepare papers for publication and at least one paper for presentation at the forthcoming meeting in Cleveland.

We count on you for full support!

Fraternally yours,

Arno Viehoever, *Secretary.*

Heber W. Youngken, *Chairman.*

NEWS ITEMS AND PERSONAL NOTES

Annual Convention of the American Pharmaceutical Association Meets in Cleveland, Ohio.—The seventieth annual convention of the American Pharmaceutical Association will meet in Cleveland, Ohio, during the week of August 14th. The convention will be held between the dates of the fourteenth and twentieth.

This will be the first time the convention has met in Cleveland for fifty years. In other words, it is the golden anniversary.

The headquarters will be at the Hotel Statler, which is located in the very heart of Cleveland and within five or ten minutes' walk of all the principal hotels and all the major business houses. Plans have been perfected with the hotel whereby mailing cards will be sent to every member of the association. These cards will carry the hotel rates, and when the hotel receives the return card the room will not only be reserved, but assigned to the individual, and he will be notified of his room number, so that his room will be ready for him when he appears. There will be no other convention in the Statler Hotel during this week. It will devote its entire energy to entertaining our association.

Plans have been partially perfected to date for a splendid entertainment program, as well as that of the business sessions.

The National Association of Boards of Pharmacy and the American Conference of Pharmaceutical Faculties will both meet at the same time.

There will be a report of the committee on reorganization of the association, that will be received and discussed at this convention. This may mean much or little but doubtess there will be some considerable discussion upon the plans, as many new ideas have been coming to the front recently as to the function of the A. Ph. A. in American pharmacy. The House of Delegates of this body will present its first report upon co-operative work with the State associations; and it is planned to keep a representative in Washington to look after the association's interests.

English Chemists' Exhibition to Meet in June.—The twenty-third Chemists's Exhibition will be held at the Central Hall, Westminster, London, S. W., on June 19-23 next, and any member of the American drug, chemical and sundries trade will be welcomed and entertained on presentation of business card.

New Bulletin on Serobacterins.—We have recently seen a copy of the latest edition (the fifth) of Mulford Working Bulletin No. 18, on the subject of "Serobacterins."

The text is illuminated with several diagrams and charts, which are very helpful in conveying a clear idea on some of the points and

advantages claimed for these products. There are also a number of authoritative reports, covering both experimental results on laboratory animals and clinical results in actual practice, together with a comprehensive bibliography, suggestions for dosage, etc., all calculated to prove interesting and helpful to the medical and pharmaceutical professions.

Copies of this new bulletin may be had by addressing H. K. Mulford Company, Philadelphia, Pa., and mentioning this publication.

The officers of the H. K. Mulford Company entertained Dr. H. S. Rusby, Director of the Mulford Biological Exploration of the Amazon Valley, at luncheon at the Manufacturers' Club, Philadelphia, on Friday, March 17.

To paraphrase Kipling, Dr. Rusby has indeed "lived more stories during his brief sojourn in South America than any novelist could invent in a lifetime," and graphically recounted his experiences, hardships, etc, all .of which were tinctured with the regret that on account of ill health he was compelled to abandon the expedition and delegate the leadership to other hands.

In addition to the officers and executives of the Mulford Company there were present a number of their district representatives who had been called to Philadelphia for an intensive course of instructions in the laboratories and to meet Dr. Rusby. These included—

M. K. Baird, Chicago; E. V. Clark, Minnesota; E. H. Long, Dallas; W. G. Stoll, Buffalo; F. C. Humphries, Florida; George Wilkes, Memphis; C. E. Greiner, Kansas City; E. A. Monell, St. Louis; W. T. Ellis, Ohio.

PROFESSOR H. V. ARNY TO RECEIVE REMINGTON HONOR MEDAL. —Announcement has just been made that the 1922 Remington Honor Medal has been awarded to Prof. H. V. Arny. This makes the third medal awarded; Dr. John Uri Lloyd and Professor James H. Beal being the recipients of the first and second medals respectively. The medal is awarded annually by a committee consisting of the Past-Presidents of the American Pharmaceutical Association, the

Secretary of the New York Branch acting as Secretary for this committee.

The actual award of the medal will take place at a banquet tendered to Prof. Arny by the New York Branch and will be held at the Hotel Pennsylvania on the evening of May 15. Dr. Diner, the Senior Past-President of the Branch will make the award. Various phases of Dr. Arny's activities which resulted in the award of the medal will be related by speakers who have been in close contact with the recipient of the medal during his years of true service to American pharmacy.

H. K. MULFORD COMPANY DISTRIBUTORS FOR MERCUROPHEN.—It may interest our readers to know that the H. K. Mulford Company have completed arrangements with the Dermatological Research Institute of Philadelphia to distribute Mercurophen, a superior mercurial germicide.

Mercurophen was developed by Drs. Schamberg, Kolmer and Raiziss and introduced by them in 1917.

Clinical data and information will be furnished on application to the Mulford Laboratories.

N. Y. Q. TAKE NEW OFFICES.—The New York Quinine & Chemical Works, Inc., one of the oldest concerns in the industry, have been compelled by pressure of business to occupy new business quarters.

On April 22d the general New York office was removed from 135 William Street to 152-154 William Street. Mr. T. R. L. Loud, Vice-President and General Manager, will continue in charge as for so many years hitherto.

The new quarters are commodious and handsome, and are admirably suited for the quick and efficient dispatch of business.

Buyers, dealers and others who have occasion to come to New York are cordially invited to make the N. Y. Q. offices their headquarters during their visit. The many acquaintances of Mr. Loud will, as always, find the word "welcome" on the doormat.

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EDITORIAL

THE PROBLEM OF AN INTERNATIONAL LANGUAGE

Considerable attention has been given lately by the learned societies in France and Italy, and even in England, to the possibility of establishing an international language. The mixture of nations brought about by the great war, and the numerous "conferences" that have been trying to settle the issues, have emphasized the advantage of some method of intercommunication other than multiplied translations. For many centuries the learned men of Europe had a satisfactory means of communication, inasmuch as they were all trained in Latin. Today, pharmacists are about the only class that still employ this language regularly. The first edition of the U. S. P. (1820) was bilingual, the Latin and English appearing on alternate pages. There is little hope that the universality of Latin will be restored. It is a very difficult language, both as to grammar and syntax, and the attention of those who are promoting the adoption of an international tongue is directed to either the development of an artificial one, or the adoption of some existing language. The latter plan is generally regarded as impracticable, national jealousies being too strong. For many years French has been the language of diplomatic affairs, but has lost a little of late, owing to the extension of English. Of the "Big Four," who controlled matters at Versailles, three spoke English, and the fourth, the Italian representative, had an excellent interpreter. Frenchmen, indeed, have had some qualms as to the future of their language in diplomatic circles.

As regards artificial languages, it is to be noted that many have been constructed, but none has obtained any extensive recognition. Esperanto has been most successful, and is looked on with some favor by the promoters of an international tongue. A few serious defects in it have led to suggestions of improvement, and the

amended tongue has been called "Ido." Esperantists generally have been anything but indulgent towards the reformers. A troublesome feature of Esperanto is the accented letters. It is a great bother to be obliged to place such accents. French is very trying in this respect.

It is a serious question whether any artificial language so far offered will serve the purpose intended. Several objections attach to any such scheme. In the first place, the study of an artificial language opens no new literature. All its texts are translations from other tongues. Secondly, it is a question whether the numerous idioms in the spoken tongues will not be carried into translations and give rise to confusions. An instance of the difficulty of dealing with idiomatic expressions occurred lately. Mr. Wells wrote a story entitled "Mr. Brittling Sees It Through." It was intended as a promoter of *morale*, and was naturally translated into French, but the translator misunderstood the phrase, and his title means "Mr. Brittling Sees Through It." The construction of an international tongue must be carried out with great care, and especially the verb-forms must be thoroughly analyzed so that the expressions may be constructed upon the exact significance desired, and not, as is often done, by a crude analogy with the verb-forms of the language from which the translation is made. Thus, in German, the subjunctive is commonly used in reporting the words of another person; in French the same mood almost invariably follows "que." Neither of these forms is fundamentally important, and the artificial tongue must eliminate both so well that a German or a Frenchman cannot fall into the error of repeating idioms of the respective languages. Esperanto has an accusative case used after verbs of motion. This is wholly unnecessary. Four great languages, French, Spanish, Italian and English, operate perfectly well without any distinction between the nominative and objective, except as to pronouns. Esperanto nouns all end in "o" and are, of course, all without distinction of gender, but the opening line of the Esperanto anthem,

"En la mondon venas nova sento"

requires the accusative form, because it means "into the world comes new thought."

The problem of a written language for world use is difficult enough, but that of a spoken one is far more difficult. There are marked and very peculiar differences in the pronunciations of the

great languages of western Europe. German has the palatal "ch," and the umlauted vowels; French has the nasalized syllables; English has the two "th" sounds. Spanish-speaking persons find it very difficult to pronounce a combination of "s" with another consonant—such as "st," "sp"—without uttering an "e" first, so that in beginning to speak English, Spaniards generally say "estreet" and "estand." English has in several respects great advantage, such as its almost entire lack of formal grammar, especially the absence of distinctions of gender in its nouns and adjectives and the simplicity of its verb-forms, but the outrageous confusion of its spelling constitutes a serious practical objection. Spanish is probably the most suitable of the modern tongues for international use. Its pronunciation is as nearly phonetic as a living language can be, its grammar is simpler than that of most of the languages of Continental Europe, and it is melodious. Curiously it has the sibilant "th" and a palatal sound analogous to the German "ch." Italian is also a closely phonetic tongue, but it is not likely that the language of any nation competing in the world struggle will be adopted for international purposes. Spain is out of this race and, therefore, her language might have a chance.

Undoubtedly great benefit will follow the adoption of some method of communication between scientists that will relieve them from the necessity of studying several languages, but the problem is an extremely difficult one and does not seem to be appreciably near solution. Between Esperanto and Ido, the latter seems to be preferable. H. L.

ORIGINAL PAPERS

THE RAW MATERIALS OF THE CHEMICAL INDUSTRY.*

By Prof. Samuel P. Sadtler, Ph.D., LL.D.

(Professor Emeritus of Chemistry, Philadelphia College of Pharmacy and Science.)

The function of the chemist is not purely, or even mainly, to determine the composition of matter. There was a time in the past when the analytical side of chemistry was made of chief importance,

*One of a series of Popular Lectures delivered at the Philadelphia College of Pharmacy and Science.

but this was in the beginning of the science. The French chemist, Lavoisier, who may be said to have established modern chemistry on its exact foundation, in 1793 defined chemistry as "the science of analysis." And there is no doubt but what this side of the subject was, for a long time, the main pursuit of chemists.

This, in a sense, was a necessary and a natural course, because until the methods of analysis had improved, we could have known very little of the chemical elements, and we would not have been in a position to talk of a chemical industry built up on definite foundations.

However, by the middle of the last century already, the definition, before referred to, was modified, and the French chemist, Berthelot, defined chemistry as "the science of analysis and synthesis." And since that time chemistry has accomplished its chief results in the field of synthesis.

Great chemical industries, therefore, have only developed in this latter period of time, because until synthetic work could be brought to supplement the work of analysis, such industries were impossible. The great coal tar industry may be said to have been founded in 1856 with the discovery of the first aniline dye color, yet the substances, benzene, aniline, phenol, etc., had been identified by skillful, analytical methods prior to that time.

A chemical industry, therefore, is, in the special sense of the word, a creative industry. It builds up from crude material found in nature, or from definite simple substances extracted by analytical methods, valuable products available for a multitude of uses in our daily life.

I have taken as my subject "THE RAW MATERIALS OF THE CHEMICAL INDUSTRY." The successful development and establishment of the chemical industry is primarily based upon the supply of cheap and satisfactory raw materials. We will review, therefore, some of the more important industries based upon the utilization of inorganic and organic raw materials, and consider how we are situated for the development of these industries in this country by reason of our possession of suitable raw materials.

The first raw material in any manufacturing industry, the possession of which in sufficient amount, and at satisfactory price, is essential, is fuel of some kind. We will, therefore, take up first the subject of fuels, and note the position which the United States oc-

cupies in its possession of this important primary essential for successful chemical manufacturing. We may review briefly the case of solid, liquid and gaseous fuels, and note the situation with respect to each of these.

The solid fuel found most abundantly in nature, and most valuable, is coal. The United States possesses practically all grades of this essential fuel, namely anthracite and bituminous coals and lignite naturally occurring; and from these is able to manufacture the modified fuel, known as coke, to great advantage. As is known, the anthracite coal of Eastern United States is the most valuable deposit in the world of this high grade fuel. There are lesser deposits of the same kind of coal elsewhere in this continent, as in British Columbia, but they have not yet come into any extensive use.

Still more available, are the great deposits of bituminous coal found in almost every part of the United States, but notably east of the Mississippi River. From bituminous coal, by a process of destructive distillation, is then produced coke, which represents the fixed carbon of a bituminous coal, while the volatile matter has been driven off, either wasting it, as in the old bee-hive oven, or collecting it to great advantage, as in the modern by-product coke oven, in which hydrocarbon gases, coal tar and ammonia are all collected and in the aggregate form most valuable materials for either direct use or serving as intermediates in the production of other chemical compounds.

In the chemical industry, bituminous coal, in recent years, has been used very extensively in the form of a finely powdered coal, in which case it can be used to great advantage by burning it mixed with a current of air from jets, whereby the maximum heat of combustion is realized. This may be said to have begun in the cement industry, where the rotary kilns are heated by this mixture of powdered coal burning with a current of air, but the use of the solid coal in powdered form has been extended quite widely. It is stated, for instance, in 1919, from ten to twelve thousand tons of bituminous coal were pulverized for industrial use. Of this, about six thousand tons were used in the Portland cement industry, and two thousand tons in the iron and steel industry. This method of using fuel developed in the United States, and has become more widespread with us than in any other country, although it has been introduced more recently also in England, France and Japan.

Coke is used directly as solid fuel in very many metallurgical industries, particularly where the reducing action of carbon is desired in chemical operations. Modifications of the use of coke in recent years are found in the briquetting of it with pitch, etc., and in the mixing of it with fuel oil, whereby the fine coke is used to great advantage.

Under liquid fuels we have the most important substance, called petroleum, which has become increasingly valuable and necessary as an element in industry, as well as in every-day life. Looked at from the standpoint of the chemical industry, petroleum is most generally utilized in the form of fuel oil, representing a heavy end of the petroleum distillation from which already the gasoline and the kerosene have been driven off.

Fuel oil, or thick oil residuum, is of the greatest value because of the completeness with which its combustion can be effected in practical use. Not only that, but it is also a highly condensed hydrocarbon mixture of the highest fuel value. The B. T. U., or British Thermal Unit Value, of a fuel oil will, for instance, stand as high as eighteen thousand B. T. U.'s per pound; whereas, thirteen to fourteen thousand would be a value for a good bituminous coal, and perhaps twelve thousand for an anthracite, when the ash necessarily reduces the value per unit of weight. Besides the burning of fuel oil direct, the burning of it in Diesel engines is becoming more widespread as a direct source of power.

The abundance of this liquid fuel or petroleum in the United States is a great advantage for our chemical industry. At the present time, the United States produces slightly more than two-thirds of the world's annual petroleum supply, and with the addition of the supply from Mexico, which is very easily available for us, we have a great advantage over any other part of the world in this matter of fuel.

If we turn to gaseous fuels, we find similarly a very satisfactory case in the fact that in the United States we have natural gas, which is generally over 90 per cent. pure hydrocarbons, very abundantly occurring, associated with the petroleum production. This is, of course, a still more perfect fuel even than the liquid fuel, because of the perfection with which the combustion is effected.

In many industries, artificial gaseous fuel is used, namely producer gas, where a natural gas is not available. Of course, pro-

ducer gas, made by blowing air through highly heated fuel, and producing a mixture of carbon monoxide and nitrogen, is of much lower fuel value than the natural gas, but still it is a cheap and convenient form of fuel. This is available where the different kinds of coal are had as the starting point in its manufacture.

To sum up, American chemical industries are most favorably situated with regard to the fuel supply. And with any reasonable care in the utilization of this raw material, they have a great advantage in operation.

In connection with this survey of fuels considered as the basic raw material for chemical industries, it is worth while noting that many chemical industries are developing in countries in which the natural fuels above enumerated are almost entirely wanting. This is by reason of the development of what are called hydro-electric power installations. Countries like Norway, Switzerland and Italy, in which coal deposits are almost entirely wanting are yet successfully developing chemical and other manufacturing industries by reason of their available water-power resources.

If we ask the question as to how this country is situated for such development, we find that conditions are potentially favorable, in that we have abundance of water-power readily available, and a very considerable beginning has already been made in this line. And where such a development has been made, chemical industries have promptly located in considerable degree to the exclusion of other applications for the newly developed water-power. We need only refer to the large developments of the chemical industries at Niagara Falls, Sault Ste. Marie, Mich., and in the State of Maine. Some references to these will be made later in speaking of individual chemical industries.

ACID AND ALKALI MANUFACTURE.

As basic chemical industries underlying many secondary developments in manufacturing are the industries of the important mineral acids—sulphuric, nitric and hydrochloric; and of the alkalies, such as sodium carbonate and caustic soda and potash.

It has well been said that sulphuric acid is to the general chemical industry what the manufacture of iron is in the metallurgical field. The manufacture of sulphuric acid has grown steadily, of course being very greatly increased by the demands for the manu-

facture of ammunition and war products in recent years. It was stated in January, 1921, that the present manufacture of sulphuric acid in the United States amounted to about six million tons, calculated to 50° Be. strength. While this shows the result of war stimulation as before remarked, it is very probable that the amounts demanded in the immediate future will not fall much below this, as with the return of industrial activity the great demands for sulphuric acid will continue. We need only recall that the manufacture of phosphate fertilizers is entirely dependent upon the use of sulphuric acid to decompose the natural phosphates, and it is estimated that half the production of sulphuric acid in normal times goes into this utilization.

Somewhat less in amount, but still a very large consumer of sulphuric acid, is the petroleum refining industry. But there is hardly a chemical industry that can be considered that does not call for sulphuric acid as one of its most important reagents.

Now the raw materials for the sulphuric acid manufacture are primarily sulphur; and secondarily nitrates, either natural or artificial.

The first of these raw materials can be had either in the form of native sulphur, or by the roasting of pyrites to produce the sulphur dioxide needed in the reaction for sulphuric acid manufacture. As long as the sources of supply of native sulphur were the Sicilian sulphur imported into the United States, it was considered cheaper to utilize pyrites. This pyrites was in part brought by importation from Spanish mines, and in part was native pyrites of which we have numerous large deposits, notably in the State of Virginia. But these conditions of supply have been practically completely changed in recent years.

There was discovered a few years ago a large deposit of native sulphur in Louisiana, which, although occurring at a considerable depth below the surface, was made available by the introduction of the Frasch process, whereby the sulphur is melted by forcing heated water under pressure down through the annular space of the tubing of the well, and forcing the melted sulphur, under pressure, through a central tube so that it is delivered at the surface in a continuous stream in the molten state. This was very successfully developed by the Union Sulphur Company, and speedily had its effect upon the

price of crude sulphur, and upon the figures of importation of sulphur into the United States.

This discovery in Louisiana was followed by the discovery in the adjacent sections of Texas of similar deposits, which are worked in exactly the same way and have speedily added enormous production to that begun by the Union Sulphur Company. These were the Freeport Sulphur Company and the Texas Gulf Refining Company. Developing rapidly, the present domestic production of sulphur from these several sources now amounts, according to Dr. R. F. Bacon, of the Mellon Institute, to one million tons annually, and with the possibility of increase, if demand arises, to several times that much. Moreover, this sulphur is of high purity, being distinctly superior to the Sicilian sulphur in that respect, being guaranteed as 99.9 per cent. sulphur.

Dr. Bacon calls attention to the development of this American source of supply, and cites the following striking illustration of the same. In 1900 all but 5 per cent. of the world's supply of native sulphur came from Sicily, while in 1917, 80 per cent. of the world's supply of sulphur came from the United States.

As to the secondary raw material needed for the sulphuric acid manufacture, above mentioned, namely nitrates, this of course applies only to the manufacture of sulphuric acid by the Chamber Process. With the Contact Process, which is increasing steadily relatively to the older Chamber Process, we have only the sulphur to consider as a fundamental raw material. We will refer to the nitrate raw supply now in speaking of nitric acid, the second of the important mineral acids.

Nitric acid is second in importance only to sulphuric, and during the late war there was an abnormal demand for nitric acid as the material for the production of high explosives. This will be seen from the citation of a few figures. In 1914, the American production of nitric acid was 79,000 tons; in 1917, this rose to 404,000 tons; and in 1918, to 634,000 tons; but in 1921, the production had dropped to slightly above the 1914 figures.

So far, the chief raw material for the production of nitric acid in the United States has been the sodium nitrate imported under the name of Chile salt-petre. We have heard much of nitrogen fixation and the necessities for successful development of such a process as a means of supplying us both with nitric acid for the arts and for

explosives and of ammonia for fertilizer manufacture; but the fixation of nitrogen from the atmospheric air can hardly be said to have been begun commercially as yet in the United States.

It is true that during the war, under the insistent demand for nitric acid for high explosives, the DuPont Company installed the Birkeland-Eyde electric furnaces for the manufacture of nitrogen oxide direct from the air, but this process requires cheap electrical energy, which, though readily available in Norway, is not as yet available in sufficient degree to make it commercial in this country.

On the other hand, the fixation of nitrogen to form ammonia has been done in this country, similarly under war pressure, by the Cyanamid Company (to be referred to later), and by the General Chemical Company, using a modification of the Haber Process. This process, or a modification of the same, is now being operated by the Solvay Company at Syracuse, New York, who are affiliated with the General Chemical Company, and are using their improvements of the Haber Process, which were developed during the war. Whether we will have, in the near future, the production on a much larger scale of ammonia by atmospheric nitrogen production at Muscle Shoals, Alabama, will depend upon the slow negotiations which are now going on between Congress and Henry Ford and others, who are planning to take up this manufacture on a large scale.

Of course, in speaking of ammonia, it must be borne in mind that ammonia is readily oxidizable to nitric acid, and may be considered as a step in the manufacture of nitric acid, if desired.

The third of the important mineral acids is hydrochloric acid. This was formerly made, and is still to some extent, by the action of sulphuric acid upon salt. In this country, the development of the manufacture of electrolytic hydrochloric acid by the electrolysis of salt solutions has established itself in a very satisfactory way at Niagara Falls, and the future production of hydrochloric acid will be largely electrolytic. In either case, the fundamental raw material is salt.

The United States is very favorably situated for the production of this raw material. The salt industries have long been established in New York State, in Western Pennsylvania, and in Ohio and West Virginia, but at the present time the chief salt producing locality in the United States is the eastern section of Michigan. Very pure beds of salt from 100 to 400 feet in thickness are worked for the produc-

tion of brines from the same. An interesting observation also is that these Michigan brines at a depth of about 700 feet contain bromides, and hence serve as the American source of bromine. But at 1600 feet depth, we have a stratum of extremely pure salt free from bromides, and yielding the purest refined salt as its product.

There are many localities throughout the United States where salt is available, not only by working of salt wells for the production of brine, but where compact beds of very pure rock salt are found as a product of ordinary mining.

The most important alkali manufactured on a large scale is soda. We distinguish here between sodium carbonate (soda ash) and caustic soda (sodium hydroxide). The raw material in both cases is again salt, or brine. The older process of manufacture of soda ash, known as the Leblanc process, was never established in this country, but the Solvay process, or so-called ammonia-soda process, has been operating very successfully for many years as an affiliated company with the original Solvay Company of Belgium.

The raw material for their manufacture is salt in the form of brines, which are produced in the neighborhood of Syracuse, New York, where the Solvay Process Company has its plant. Several other alkali companies, working by the same general method, and utilizing brines, are located in Michigan along the Detroit River.

In addition to this production of sodium carbonate may be mentioned also the process worked by the Pennsylvania Salt Company, taking cryolite as raw material. This mineral (a double fluoride of sodium and aluminum) is brought from Greenland, the only locality in which it is found in quantity.

Besides the artificial production of sodium carbonate there has developed in recent years the production of natural sodium carbonate from alkali lakes, or alkali deposits in the far West. Two of these localities have been commercially developed, both in the State of California, namely Owens Lake in Inyo County and Searles Lake in San Bernardino County.

At Owens Lake there are three companies now producing natural sodium carbonate or soda-ash, the problem being mainly the concentration of the natural alkali water of the lake, and the crystallization therefrom of the sodium carbonate. By fractional precipitation, it is separated from the accompanying salts which are found in smaller amount.

At Searles Lake, on the other hand, the concentrated brine is a solution containing predominately sodium and potassium chlorides, with smaller amounts of sodium carbonate and sodium borate. There are four companies operating here, the most important being the American Trona Corporation, and the Solvay Process Company.

There are other natural lakes and solid deposits of alkali, in the Western States, but none of them, as yet, producing any quantity of sodium carbonate, the Nebraska Lakes being worked particularly for potassium salts.

Caustic soda is produced by a modification of the procedure in working the ammonia-soda process, but increasing amounts of caustic soda, and probably the great bulk now is made by electrolytic methods. Here, of course, brine is the raw material. Not only is this carried out on a large scale at Niagara Falls, but very many chemical plants, notably the paper and pulp mills have their own extensive installations of electrolytic soda-producing cells. With brine available as a cheap, raw material, therefore, the manufacture of both sodium carbonate and caustic soda have become flourishing industries.

LIME AND MAGNESIA PRODUCTS.

A number of industries in which chemical reactions are involved require the use of large amounts of lime and, in a similar way, but in a smaller degree, the use of magnesia, besides the use of lime in the mortar and cement industry, and of magnesia in the manufacture of refractory furnace brick and similar products.

Of those minerals furnishing lime as raw material may be noted: the carbonate of lime, or limestone, which by burning yields quick lime and caustic lime; and calcium sulphate or gypsum, which, on heating yields plaster. These raw materials are obviously then of vital importance in many industries. They are abundantly found in many parts of the United States, and in consequence the industries of burning lime and preparing lime for utilization in chemical industries have been very extensively developed.

The use of lime in the ammonia-soda process may be taken as an illustration of its value as a chemical reagent, and the use of limestone as a flux in the iron blast-furnace process may be taken as an illustration of the use of the same raw material on a large scale.

The manufacture of all grades of cement, and notably of Port-

land cements, have also developed enormously in the United States, and here the mixtures of limestone and clays are the necessary raw materials.

Another chemical industry of large development is the manufacture of bleaching powder, and bleaching solutions, for which lime, and, in the case of the sulphite paper process, magnesia are necessary raw materials to be converted into the finished products, either calcium hypochlorite or calcium and magnesium bisulphite, respectively.

Still another very important chemical industry in which lime enters as a necessary raw material is the manufacture of calcium carbide. This is a high temperature electric furnace product using limestone and coke as the raw materials which react at the high temperature of the electric arc to produce the compound of calcium and carbon. This latter is valuable in two ways. It reacts with water to liberate acetylene gas, which is of great value as an illuminant in acetylene lamps, and also has come into extensive use in the process of acetylene welding, developing with oxygen an enormously high temperature by the aid of which the welding of heavy metal castings and forgings, etc., is easily effected. And then again, calcium carbide is needed as a step in the manufacture of calcium cyanamid which is coming into extensive use as a basis of fertilizer mixtures. The carbide industry is extensively developed at Sault Ste. Marie, and the cyanamid industry at Niagara Falls.

The mineral magnesite, or native magnesium carbonate, has become of great value in recent years as a raw material in the manufacture of furnace brick linings of high refractory quality for the steel companies. The purest magnesite needed for this purpose was brought for a considerable time from Greece and Asia Minor. It is now, however, produced very extensively in the two States of California and Washington. The production in these States in 1920 amounted to 303,000 tons, while importations of magnesite amounted to 43,154 tons only.

Besides magnesite, another raw material is the double carbonate of lime and magnesia known as dolomite. This serves as a valuable source for the magnesia products used in the magnesia insulation industry which has developed very extensively in this country, the products of which having found a multitude of uses.

ALUMINUM AND CLAY INDUSTRIES.

Clay is essentially a silicate of aluminum. The extraction of the metal from clay is, however, not so readily practicable so that this cheapest of raw materials is not available for the production of the metal. However, there occurs in large deposits a mineral which is a hydrated aluminum oxide, under the name of bauxite.

This is the present source for the production of metallic aluminum. From the crude bauxite is first extracted the pure aluminum oxide, and this by the Hall process is dissolved in melted cryolite and directly electrolyzed for the production of the metal.

The bauxite was first obtained from France, but later it was found that we had abundant deposits in the States of Alabama, Georgia and Arkansas, from which sources a half a million tons of bauxite are now produced.

Not only is bauxite the raw material for the production of the metal, but it is found that bauxite simply fused in the electric furnace makes a better abrasive than the natural emery or corundum, and it is now sold for this purpose under a variety of names, such as "aloxite," "alundum," "exolon," "lionite" or "coralox." The alundum refractory-ware used by chemists is made from the fused bauxite by working it up with bonding materials into crucibles, muffles, and other forms, and baking these in a kiln. The product is porous and not attacked by acids, and therefore of the greatest value for filtration in chemical operations.

While the first artificial abrasive that came into extensive use was carborundum, or silicon carbide, these newer abrasives made from bauxite have found a more extensive development, the present manufacture in this country of the aluminum abrasives being as about eight to one in comparison with the carborundum production.

Metallic aluminum, as made by the Hall process, has proven to be a very valuable metal for a great variety of uses, because of its extreme lightness, and other valuable qualities. It also forms a series of very valuable alloys with copper, known as aluminum bronzes, which are used for a great variety of purposes.

The most valuable chemical salt of aluminum is aluminum sulphate, which is used as such, or when crystallized with an alkaline sulphate as alum. The extensive uses of aluminum sulphate in the manufacture of sizes for paper and for the clarifying of water are

of course well known. It is also well known as an astringent in medicine. The aluminum silicates or clays form the basis of a great variety of industries. Clay is the basis of the pottery and ceramic industries, which are extensively developed in all parts of the United States, notably in the States of Ohio and New Jersey. All of the raw materials for these lines of manufacture are now available from domestic sources, although certain clays considered necessary were imported until the beginning of the late war.

Another use for clays is in filtration. While natural clay filtration for waters is a very old and well-known illustration of this, it has only been in relatively recent years that the use of special clays, such as fuller's earth, have come into extensive use for oil filtration. Very important in this connection, is the colloid character of the clay, because particularly these clarifying effects in filtration are due to the phenomena of adsorption of colloid surfaces.

The chemist has come to make extensive use in manufacturing operations of chemical stoneware. This industry had developed very greatly in the United States during the recent war period. Acid-proof stoneware, for the manufacture of nitric and hydrochloric acids, for use in electrolytic cells, battery jars, nitrating kettles and autoclaves, are all illustrations of this development. The American chemical stoneware, utilizing domestic raw materials, has had a wonderful development.

The total value of all ceramic products made in the United States in 1918, according to the Bureau of Mines, amounted to about $447,000,000. Of this sum $222,000,000, or nearly one-half, represented clay products, the balance being glass or other silicate production not involving clay. Of the clay products 76 per cent. covered brick, tile and other structural materials, and 24 per cent. of the finer wares classed as pottery.

SILICA AND CLAYS.

An extensive line of industries are based upon the utilization of silica. In the form of sand or crushed rock, we have here the production of fusible silicates of alkali and lime with other metallic oxides known by the collective name of glass. If an alkaline silicate alone is manufactured with no addition of other base, we have what is known as water-glass or soluble glass. The uses of water-glass have developed very greatly in recent years, and its manufacture has responded to the widespread demand for the water-glass.

The raw material for the manufacture of glass, namely silica, is found very abundantly in very satisfactory quantity in all parts of the United States, because of the large sand-stone and quartz formations.

Another silicon compound to which reference was previously made is silicon carbide, known commonly as carborundum. This was discovered in 1891 by Acheson, and represented a product of high temperature electric furnace action, the raw materials being clay, carbon in the form of coke, saw-dust to make the mass porous, and salt to add fusibility. The resultant product, however, has the formula CSi, being a definite compound of the two elements, carbon and silicon. It is, in hardness, next to the diamond, and is superior to the native corundum or aluminum oxide, and has been very extensively used as an abrasive.

FERTILIZERS.

The three essential elements that seem to be necessary for nourishing the soil, and making it adapted for plant growth, are nitrogen, potassium and phosphorus. Of course, it is understood that these must be in some assimilable form of combination, sufficiently soluble in water to be taken up from the soil in the growth of the plant. Their fundamental importance is recognized when we are told that one ton of wheat takes away from the soil about forty-seven pounds of nitrogen, eighteen pounds of phosphoric acid, and twelve pounds of potash.

These essential materials have been added in crude form even by those practicing the most primitive methods of farming and long before the days of the development of scientific agriculture, and an understanding of soil fertility. For instance, the use of wood ashes, practiced from the earliest historic times, supplied the potash, and animal manure supplies the nitrate and the phosphoric acid.

However, in the development of scientific agriculture, we have come to recognize the necessity of a fertilizer industry, specially developed with reference to the understanding of agriculture. The chief raw material for the supply of the phosphoric acid is the naturally occurring phosphate rock, which is an insoluble calcium phosphate. This raw material is one of the most abundant and readily available materials in the United States. The States of Florida,

South Carolina and Tennessee, in the east, and Montana, Idaho, Wyoming and Utah, in the west, are all either present or prospective phosphate producing localities. Of course, it is not to be forgotten that the insoluble calcium phosphate must be converted into a soluble form before it can be assimilated by the soil waters, and this is done by converting the neutral phosphate into an acid phosphate or superphosphate by the action of sulphuric acid.

The phosphate industry, therefore, is distinctly an American industry because of this abundant supply of raw material, the only other readily available source, even for European supply being the Algerian phosphate deposits.

The nitrogen supply for fertilizer purposes may take various forms. In addition to the nitrogen-fixing bacteria found on leguminous plants and hence forming a somewhat limited naturally occurring nitrogen supply, we have nitrogen in the form of nitrates, ammonia salts, and the artificial product before mentioned, cyanamid.

In a previous statement, under the subject of nitric acid, I have already referred to the sources of nitric acid, namely the Chilean salt-petre or sodium nitrate found naturally and nitric acid produced synthetically by the oxidation of ammonia. We have a very limited supply of natural nitrates, chiefly potassium nitrate, or native salt-petre, in the dry districts of Nevada and Southern California. These, however, are not as yet sufficiently accessible or rich enough to make them immediately available in comparison with the Chile salt-petre. We are, therefore, mainly dependent upon this source of supply for the nitrate fertilizer ingredient in our manufacture of agricultural fertilizers, the amount so imported being something like a million and a half tons annually. Due to the very probable speedy exhaustion of these Chilean nitrate beds, there is every incentive to find a substitute which will probably be obtained by the application of nitrogen fixation methods.

We have, however, in ammonia salts another form of available nitrogen for fertilizers, and the production of ammonia as a by-product of the gas works, or of the coke oven distillation has been developed very greatly in recent years. This ammonia in the commercial form of ammonium sulphate goes, of course, extensively into the manufacture of fertilizers. Calcium cyanamid is a very valuable synthetic product made from calcium carbide, to which reference has already been made, by heating it to about 2000° F., and passing

pure nitrogen into the heated mass. It is absorbed by the carbide with the production of calcium cyanamid. Calcium cyanamid treated with superheated steam yields ammonia, or more slowly in the presence of moisture decomposes, producing ammonia and calcium carbonate, both of which are desirable under conditions for the soil. The manufacture of cyanamid mixtures for fertilizer use, therefore, has developed very greatly in recent years.

The third element to which reference was before made as essential for fertilizer material is potash. While potash is an abundant element in numerous minerals which are widely distributed, it is there locked up in insoluble form, and must be liberated and made soluble. On the other hand, there are a few soluble salts of potash available; one of these is the carbonate produced in the burning of wood, and hence found in wood ashes, to which reference has been made. This, however, would be a very inadequate source of supply, as the use of wood as a fuel has passed out of present practice.

Other soluble salts are the chloride and the sulphate. These are found as originally deposited by the evaporation of sea water in the so-called potash salt deposits of Stassfurt in North Germany and of Alsace, but unfortunately not as yet in satisfactory or corresponding availability in this country.

Nevertheless, under the conditions which prevailed during the late war, when the supply of German potash salts was cut off, very assiduous search was made for American sources of supply for these soluble potash salts. The chloride has been found in a number of our western saline lake deposits, but never in as pure a state, or segregated as distinctly as in the Stassfurt occurrence. For instance, the raw brine of Searles Lake in San Bernardino County, California, contains about 5 per cent. of potassium chloride. The same brine, however, contains about 16½ per cent. of sodium chloride, about 7 per cent. of sodium sulphate, nearly 5 per cent. of sodium carbonate and 1½ per cent. of sodium borate. Therefore, the extraction of potassium chloride in a sufficiently pure form from this salt admixture involves the practice of fractional precipitation, and very careful working to eliminate these other salts, and particularly the borate, any quantity of which is claimed to be injurious for the potash in any fertilizer application. The American Trona Corporation produces a potassium chloride from 90 to 95 per cent. pure, containing only traces of borax.

At Salduro, Utah, there is also a potassium product from brines not quite so complex, and involving only the separation of potassium and sodium chlorides, which is not so difficult to effect. In Nebraska are numerous salt lakes and marshes containing mixed potash and sodium salts. From these considerable quantities of potassium salts have been obtained.

At Marysville, Utah, is found an extensive deposit of the mineral, alunite, or natural potash alum. This is worked for potassium suphate by a process of roasting and leaching.

In considering our American sources of potash salts, we must not overlook the fact that has been shown that in the manufacture of Portland cement, the flue dust frequently contains notable quantities of soluble potassium salts. These have arisen from the presence of potash in the shales used for cement manufacture. Successful efforts have already been made to wash the flue dust, and to practice electrical precipitation by the Cottrell process for the recovery of these potash salts. The total amount so obtainable would be very great, but as yet not much has been extracted from this source. Of the insoluble potash minerals which have been considered as sources of potash salts, following a treatment or opening up of the insoluble mineral, may be mentioned feldspar, leucite and the green sand of eastern New Jersey. None of these, however, have as yet produced successfully any large quantities of potash salts.

METALLURGICAL INDUSTRIES.

The extraction of metals from their ores, and the treatment of the metals so extracted to give them desirable qualities, whether by alloying them with each other, or by various kinds of heat treatment is of course a branch of chemical industry. America has taken a very advanced position in this branch of chemical industry, and in some cases has been the pioneer in the developement of useful metals and products from the same.

It is not necessary for us to refer to the fact that the United States is by far the largest producer of iron and steel in the world, as we have been blest with abundant supplies of raw materials of all grades. But we will refer merely to recent developments of so-called various alloys. Manganese-steel, nickel-steel, chromium-steel, tungsten-steel, vanadium-steel and molybdenum-steel, are a few of the many alloys of iron whereby special, and in some cases very

highly desirable qualities are imparted to the steel. High-speed tools, acidproof metal and stainless steel represent products of this kind in which specially desirable qualities have been attained by the production of suitable alloys.

One of the most valuable metals which, until in recent years, was referred to as a rare metal is tungsten; yet it is stated that under the urge of war demand between May and December of 1918, there was manufactured in the United States more than 45,500,000 pounds of tungsten steel containing some 8,000,000 pounds of tungsten. The ore comes from Colorado and California.

Tungsten has also developed a most important use since it has been found possible to draw it into wire, namely the manufacture of the tungsten filament for Mazda lamps.

Reference was before made to aluminum alloys, such as the aluminum bronzes. Other alloys of aluminum, however, have been developed in recent years that are specially characterized by lightness and great strength such as "magnalium" and "duralumin." Many substitutes for platinum have been developed because of the high price of platinum, and the importance of it to the chemist.

Copper is a very important element for a great variety of uses, both used as such, and in the formation of alloys like brass and bronze. The metallurgy of copper has been developed in the highest degree in the United States, and considerably more than half of the world supply of copper is now of American production. The fundamental importance of copper in the electrical industries explains the relative position of copper among the metals.

Lead and zinc are also two metals which are produced on the most extensive scale in the United States, not only because of the valuable uses of the metals themselves, and their alloys, but because of the valuable pigments that can be made from them. The manufacture of white-lead, zinc-oxide and lithopone paints have become very large industries.

Nickel is a metal which has also developed steadily until it now holds a very important position, mainly because of the valuable alloys formed from it. While the working of nickel has extensively developed in the United States, we are practically dependent upon Canadian ores for this metal, namely the two localities of Sudbury, where it occurs associated with copper, and Cobalt, Ontario, where it occurs in silver-bearing ore. The association of the nickel with

copper has led to the production of a most valuable alloy of these two metals directly obtained by reduction from the natural mixture of the ore. This is the so-called Monel metal, which has many very valuable properties, chemical and electrical.

The precious metals, particularly gold and silver, have been produced extensively in the United States, although in the case of the former, America is no longer the chief source of its production.

Lastly, we may refer to the production of the interesting metal, radium. The chief production of radium, furnishing practically the main supply of the world is from the American mineral, carnolite, found in Colorado and the extraction of the metal is almost exclusively carried out in this country.

BITUMINOUS MATERIALS.

The chemical industries based upon bituminous materials of some kind are among the most important in the whole range of chemical production. We have already referred, under the heading of fuels to the production of petroleum and natural gas, which is associated with it in nature. We will not, therefore, expand upon the subject here, although the petroleum products figure not only as fuels, but also as among the most important illuminating products, and from the heavy oils are produced lubricants which are of indispensable value in all mechanical lines.

In addition to petroleum, we may note under this heading of bitumens, the importance of asphalt. Asphalt is a chemical closely related to petroleum, and in fact, is found in many cases directly associated with it, so that many crude oils yield an abundance of asphalt left as residue after the distillation of the illuminating fractions. However, there are occurrences of asphalt in compact form independent of the liquid petroleum. The most abundant source of asphalt for the various industries, such as the asphalt paving industry, the manufacture of mastic or asphalt cement, etc., is the Island of Trinidad, in the West Indies, from whence it is brought to the United States in bulk and worked up into a variety of products by the Barber Asphalt Company, and other manufacturers.

We must not overlook the fact, however, that there has developed a very extensive manufacture of so-called artificial asphalt made from petroleum residuums by different methods of treatment, especially by blowing with a current of air at high temperatures.

A third great natural source of supply for products of this class is the oil shales. This industry is, at the present, only a prospective industry, and does not pass beyond the experimental stage, but the discovery of enormous deposits of oil-producing shales in Western Colorado and Eastern Utah, as well as smaller amounts in other States, will certainly lead in the immediate future to the development of a great industry, as this source of supply must be drawn on in the near future to furnish the oils of all classes, to take the place of petroleum, the supply of which is certainly within sight of exhaustion.

This industry has, of course, existed for a number of years in Scotland, so that while it would not be a new industry that would be developed in the United States, the differences in the American shales and the Scotch shales will, no doubt, lead to different methods of development.

VEGETABLE AND ANIMAL FATS AND OILS.

We have here an extensive class of raw materials upon which are built a number of most important chemical industries, and a large number of which have been specially developed in the United States, either because of the immediate availability of the raw materials in this country, or because of the establishment of the industries based upon these raw materials.

Thus, we have food industries, which utilize purified oils and fats on an extensive scale, the manufacture of lubricants for which some of the vegetable and animal oils are especially fitted, and which cannot be replaced by mineral oil lubricants; the manufacture of soaps, fatty acids and glycerine by the decomposition of the fats and oils, and the manufacture of paints and varnishes based upon the utilization of the class known as drying oils. This gives us a very extensive list of chemical industries, and it would be impossible within the space at our command to even make a complete enumeration of them.

Some of these raw materials are peculiarly American in their origin. We would specifically mention, first of all, cottonseed oil, which has developed in this country extensively because of its being a by-product of the cotton crop of the United States. The cottonseed oil, when purified, is not only used as such for food purposes,

but goes particularly into the manufacture of oleomargarine and lard substitutes, and as a most valuable and available soap stock.

Equally characteristic as an oil mainly produced in the United States, is corn oil. This is available, when purified, for a great variety of uses, as a paint oil, for soap stock, and particularly for the manufacture by vulcanization with sulphur chloride of a rubber substitute, which is used extensively in mixing with true rubber.

Arachis, or peanut oil, has also been developed in this country very extensively for uses almost exactly the same as those to which cottonseed oil is applied. There is a large production of linseed oil in the United States, but enormous quantities are also imported from Europe, and particularly from Argentina. The importations of linseed oil from the latter country having amounted in 1920 to a value of $69,000,000. Linseed oil, of course, is the typical paint-making oil, because of its drying properties, although used of course for many other purposes, as in soap making, etc.

A tropical oil, not produced in the United States, but of great value, partly for food purposes, and partly for soap making, is cocoanut oil. This, the United States imports mainly from the Philippine Islands, coming into the United States by way of Seattle and Pacific points. Because of the great demands for edible oils, and for oils for the manufacture of glycerine during the war, the importation into the United States showed an enormous increase, and in 1918, it is stated that the copra (dried meat of the cocoanut) purchases amounted to about one-quarter million tons, and the cocoanut oil to more than 250,000,000 pounds. This went largely into the manufacture of a form of oleomargarine or vegetable butter substitute.

Of corresponding importance are the animal fats and oils, such as butter fat, lard and lard oil, tallow and tallow oil, and the marine animal oils, such as cod liver oil, menhaden oil and sperm oil. All of these raw materials are utilized on the most extensive scale in chemical industries well established in this country.

NAVAL STORES AND RUBBER INDUSTRIES.

While the industries based upon the use of the essential oils are important and largely developed, we will not take up essential oils in any detail as a class of raw materials, but confine ourselves to the group of products known as naval stores, which include the oil of turpentine and rosin, obtained from the southern pine, the pine oils,

and pine tar, from the same general source, and briefly note also the rubber industry, which is chemically allied because of its origin, although a very different, physically appearing product.

The long-leaf pine of our southern States furnishes the well-known turpentine balsam, which, by steam distillation yields the spirits of turpentine and the accompanying solid product known as rosin. These are distinctive raw materials, although there are corresponding varieties produced in Europe from other species of pine and fir trees. Spirits of turpentine, a refined product from this production is the basis of the paint and varnish industry along with the drying oils.

In addition to the natural exudation yielding the so-called gum spirits of turpentine, there is produced, by the steam distillation of the stumps and chipped wood, a wood turpentine, which, differing slightly from the gum spirits, is, nevertheless, available, and has become extensively used in the paint industry.

In the distillation of the pine wood, whether by destructive distillation, or by steam distillation, we also have produced what are called pine oils, and pine tar, from which latter is prepared pine pitch. The production of pine oils has become an extensive industry because they have been found to be especially available as flotation oils in the extraction of copper and zinc, particularly from the ores of those metals in which the metallic sulphides are finely disseminated. The copper industry of the United States particularly has taken enormous quantities of the pine oils as an invaluable aid in the production of the metal concentrates.

Rubber is not an American production considered as a raw material, but the rubber manufacturing industry of the United States has grown enormously, and in particular because of the manufacture of vulcanized rubber clothing, boots and shoes, and in the recent years, the manufacture of automobile tires, so that the United States is the largest single consumer of crude rubber in the world. This crude rubber may be either the crude coagulated rubber from Brazil or the so-called plantation rubber obtained from the cultivated rubber trees on rubber plantations of Borneo and Java.

Rubber manufacturers, however, partly because of the rise in price of crude rubber, and partly because of competition in price, have introduced many substitutes for the true rubber. The most

important of this is probably the analogous product from the Guayule shrub or tree grown in Mexico and southern Texas, and latterly in Brazil. Artificial rubbers are also made by the vulcanization of a number of fatty oils, as was mentioned under corn oil, but these are only used as additions to the genuine rubber for cheapening purposes. Nevertheless, they constitute invariable raw materials in most large rubber works.

THE SUGAR INDUSTRY.

The extraction and refining of sugar is a great chemical industry, and one which has been very successfully developed in the United States. There are only two great sources of the raw material to consider in this connection, the sugar cane and the sugar beet. The extraction of sugar and refining of the same from the sugar cane was the earlier industry in this country, because the sugar cane had established itself successfully in Louisiana and other southern States, and in the West Indies Islands immediately adjacent.

The extraction of sugar from the sugar beet, on the other hand, was first a French, and later a German chemical industry, and it was not supposed at first that it could be established in the United States. After long-continued effort, it was found that not only could the imported seed of the sugar beet be grown satisfactorily and with a production of a sufficiently large percentage of sugar in certain parts of the United States, but within recent years it has been found that seed of American growth and production will yield sugar beets equally rich in sugar percentage.

In the case of the sugar cane, the juice must be extracted promtply, and therefore there is produced directly in the section yielding the cane a raw sugar by the use of a moderate amount of purification and evaporation to crystallization. This raw sugar, gathered from a great variety of sources is then refined to the highest grade white, crystallized sugar in the larger sugar refineries which we find in the great cities of the Atlantic seaboard, because they draw their raw sugar material from not only the South, but from the West Indies, Central American countries, Java and the Philippines.

Within recent years, the production of sugar from the sugar cane has been developed greatly in Hawaii, and these Hawaiian sugars are brought to the Pacific Coast refineries.

The cultivation of the sugar beet began in this country in California, where it took a firm hold. Later it extended to Utah and Colorado, and more recently to Michigan, in each of which States are extensive beet sugar refineries. It has been proved, however, that the sugar beet can be cultivated with care in a great many other States, and even, in recent years, it has been cultivated in Louisiana successfully.

The beet sugar industry of the United States has advanced steadily, and, of course, owing to high prices obtained during the recent war, it has grown very rapidly, and in the year 1919-20 there was produced in the United States 726,000 tons of beet sugar, which is more than the entire production of cane sugar of the United States with Hawaii thrown in. Nevertheless, the most flourishing seat of the sugar production at the present time is probably the island of Cuba, where, with American capital and American methods, the sugar crop has been developed enormously, reaching nearly 2,000,000 tons annually.

STARCH AND PRODUCTS THEREFROM.

The American starch industry is on a somewhat different basis from the starch industry of Europe, in that the chief raw material is corn or Indian maize, with wheat starch and rice starch playing a minor part; whereas, in Europe, the potato is the chief source of supply for starch.

The American starch industry, however, has developed in a very notable way, and particularly the manufacture of the products obtained by hydrolysis of starch. The glucose industry and in more recent years, the maltose industry, are peculiarly American developments, going into the manufacture of a great variety of food products, supplementing the use of corn starch in this way, besides having found a great many other technical utilizations.

In 1919, the exportations of glucose syrup amounted to 220,380,761 pounds, valued at $13,469,051, and of grape sugar (corresponding solid product to glucose) 35,236,948 pounds, valued at $1,970,893. These figures, however, represent a maximum, and they fell off appreciably in 1920.

A very interesting side industry based upon starch is the production of valuable solvents by fermentation. The Fernbach fermentation method, whereby acetone and butyl alcohol are produced

by fermentation, had already been developed prior to the war, and was used in connection with a new method for making synthetic rubber, in which butyl alcohol was a necessary raw material.

Early in the war period, however, the demand for acetone became so great, because of its value as a solvent in the manufacture of smokeless powder that this Fernbach method was taken up and developed on a large scale in Canada, using the starch of corn as the raw material. Since the close of the war, it has been further developed, and a large plant has been established by the Commercial Solvents Corporation at Terre Haute, Indiana, in the midst of the western corn belt, for carrying this out on a large scale.

One bushel of corn, by this process, is made to yield from 9½ to 10 pounds of mixed solvents composed of 60 per cent. acetone, 30 per cent. ethyl alcohol, and 10 per cent. butyl alcohol, all of which, however, are readily separable by methods of fractional distillation. This plant referred to, has a capacity of seven tons of mixed solvents per day.

At the present time, the butyl alcohol is the most desirable of the several ingredients, because of its value as a solvent in connection with the manufacture of plastics.

DAIRY INDUSTRIES.

An agricultural production may be the basis of development of extensive chemical industries, with a full understanding once attained of the chemical nature of the raw material.

We have, first of all, milk products, including condensed and evaporated milks, and milk powders, and then a variety of distinct industries based upon the utilization of certain of the constituents of the milk considered as raw material; the manufacture of butter and butter substitutes, such as oleomargarine; the manufacture of cheese, the many varieties of which depend upon the careful control of the processes of fermentation and ripening of the milk proteids; the manufacture of sugar of milk; and the production of solid casein. This latter has become a very important material as the basis of a variety of glues, adhesives and plastics, and, in this connection, entering into a great many lines of manufacturing industry as a necessary ingredient.

Without going into details, we may say that from the dairy industries, and the original milk production, have been built up a number of most important and interesting chemical industries.

CELLULOSE INDUSTRIES.

The extraction and purification of cellulose from the naturally occurring raw materials underlies a number of very important industries. We note, first, the manufacture of what is called wood pulp for paper making, noting the distinction between mechanical pulp and chemical wood pulp, under which latter head are three well-defined lines of treatment, and the production of paper-making material therefrom, namely the soda process, the sulphite process, and the so-called sulphate process.

Enormous quantities of our American trees and available forests have been already used in the wood pulp industry, and at the present time we are largely dependent upon the importation of the crude wood pulp from Canada for our continued operation of paper-making. Still large forest reserves, however, are available in Alaska, and will in the near future serve as the materials for the wood pulp industry.

Another use of cellulose is the manufacture of artificial silk, and the manufacture of films. We have here, again, several chemical processes operating side by side in furnishing the raw material, namely the nitro-cellulose process, furnishing a filament which, after denitration is a pure cellulose; the cuprammonium process in which a solution of cellulose (obtained chiefly from cotton linters) is used; and the viscose process, in which wood pulp may serve as raw material, and is converted into a solution from which filaments are spun, and a so-called acetate-cellulose filament or film.

The artificial silk industry has developed with great rapidity in recent years, and is at present established in a flourishing way, particularly with the nitro-cellulose and the viscose methods.

On the other hand, the manufacture of films is practically confined to the nitro-cellulose film, and the acetate-cellulose, the latter being non-inflammable.

The film industry has, of course, developed with enormous rapidity because of the supplementing of the demand for photographic films by the demand for films for motion picture uses. It is stated that the Eastman Kodak Company in 1920 manufactured fifty million feet of film per month, or about one hundred and twenty-five thousand miles of film per year, for motion picture purposes.

In this connection, they use nearly 3,000,000 pounds of cotton per year, as material for their film manufacture.

We also have an important chemical industry based upon these same cellulose derivatives, namely the manufacture of cellulose plastics, such as celluloid and similar materials, the chief basis so far having been nitro-cellulose, although cellulose acetate is now coming into considerable use in the manufacture of plastics because of its non-inflammable quality as compared with nitro-cellulose.

Under the heading of the cellulose industries, we must also note the wood distillation industry. Reference was made to this already under the head of naval stores, in speaking of pine oil and pine tar. But the distillation of hard woods gives us another line of products of the greatest chemical importance, such as methyl alcohol, acetic acid and minor products, such as acetone. Of course, the residue of the wood distillation yields us fixed carbon in the form of charcoal. The hard wood distillation industry is a very important one in the United States, far exceeding that of any other country.

TEXTILE INDUSTRIES.

These are based upon the utilization of both vegetable and animal fibres. The vegetable fibres, such as cotton and flax fibres, are practically composed of cellulose, or, as in the case of hemp, jute, etc., cellulose with ligno-cellulose as an alteration product. The animal fibres, such as wool and silk, on the other hand, are of more complex composition, and in particular contain nitrogen, and, in the case of wool, also sulphur.

These industries are all developed in the United States as manufacturing industries very extensively. From the standpoint of raw materials, however, there are differences to be noted. The raw material for cotton manufacturing industry is an American production primarily, as the great supply of the world's cotton industry is found in the United States.

The cultivation of cotton is not only well established in the United States, but is extending in many ways. It is stated, for instance, that 400,000 acres in the Imperial Valley of California, and in the neighboring State of Arizona have been planted with long staple cotton, and with very promising results.

The flax fibre, on the other hand, is not primarily an American product, although there is a considerable American production. The cultivation of the flax is chiefly for the seed, and the fibre for textile uses is largely of foreign importation.

The woolen industry has become very firmly established in the United States, and utilizes domestic supply of raw material as well as considerable imported material.

The silk manufacturing industry is almost entirely dependent upon raw silk imported from China and Japan.

THE TANNING INDUSTRIES.

The conversion of hides and skins into leather, and the utilization of by-products, as in the glue manufacture, have been developed from a purely empirical practice to a carefully conducted chemical manufacturing industry. The very complex and alterable character of the hide material for a long time seemed to make the adoption of exact chemical methods very difficult, but with the increasing knowlledge of the part which colloids play in these changes, more exact chemical methods can be applied.

The manufacture of vegetable tanned leather, of alum tawed and chrome tawed leather, of chamois and oil treated leather, have all been developed in a more exact chemical way year by year.

The American leather industry has taken a very prominent and creditable part in this development. The raw materials are only in part of domestic production, as the growth of the industry has made necessary the importation of heavy hides from Argentina, and goat skins from India and the East.

The vegetable tanning, originally effected with ground bark, is now in large degree effected by the use of hemlock and oak tannin extracts produced in both the United States and Canada.

Chrome tanning, which is peculiarly an American development, calls for the use of large quantities of bichromates and prepared basic chromium salts, all supplied by the American chemical trade.

The manufacture of glue has also been developed with better understanding of both the physical and chemical laws which cover the handling of colloids such as the gelatin extracted from the hide material. Similarly, the working of bone gelatin has been developed in a more exact chemical way.

COAL TAR PRODUCTS AND COAL TAR DYES.

We have read much in the last few years of the great impetus given by the war to the production in this country of coal tar products, and the founding upon them of an American dye color in-

dustry and not only the original sources of coal tar such as the gas work production are availed of, but more particularly the tar of the by-product coke oven has been produced in very largely increased amount as a result of this impetus.

In speaking of this industry, we distinguish between the immediate products of the distillation of coal tar such as benzol, toluol, phenol, naphthalene, and higher hydrocarbons. Each of these substances just mentioned may be the special material sought as a starting point of a large chemical production. For instance, the war made necessary the production of enormous quantities of toluene for the manufacture of tri-nitro toluene (T. N. T.), one of the most important of the high explosives for shells utilized in the recent war. The production of toluene had to be stimulated, but the process of manufacturing it from California petroleum, which was developed to meet the emergency, was capable of furnishing many times more than the needed amount.

The production of phenol similarly was the starting point for the manufacture of picric acid. Of course, in the case of phenol, there has been a continuously increasing demand because of the development of the class of phenol-formaldehyde plastics, such as bakelite, and the material for the manufacture of phonograph records.

What are usually referred to as intermediates are the substances which are produced from these raw materials, and then serve as the special starting points for the manufacture of specific synthetic dyes. It is rarely realized how absolutely dependent a successful artificial dye color industry is upon the use of a large number of these intermediates. This had all been successfully developed on the largest scale by Germany prior to the war, and explains why the German coal tar dyes were used to the exclusion of all other in both England and the United States prior to 1914.

At the present time, some two hundred of these indispensable intermediate compounds are manufactured by our largest American dye color firms. From these a development of a true artificial dye color industry has begun, and with such success that at the present time hundreds of dyes of quality equal to anything previously imported are now manufactured in this country, and have already established themselves quite firmly in the requirements of the textile industry.

ISOPROPYL ALCOHOL.

By Dudley H. Grant, Research Chemist, and Carl O. Johns,
Director, Research Division, Development Department, Standard Oil Co.
(N. J.)

During the last two years isopropyl alcohol has become a commercial article in the United States. It is produced solely as a by-product of the petroleum and natural gas industry, and is made by absorbing olefine gases, containing propylene, in sulphuric acid and hydrolyzing the resulting alkyl sulphuric acids. The principal reaction may be represented by the following equations:

$$\underset{\text{Propylene}}{CH_3{-}CH{=}CH_2} + H_2SO_4 = \underset{\text{Isopropyl Sulphuric Acid}}{CH_3{-}CH(OSO_3H){-}CH_3}$$

$$\underset{\text{Isopropyl Sulphuric Acid}}{CH_3{-}CH(OSO_3H){-}CH_3} + H_2O = \underset{\text{Isopropyl Alcohol}}{CH_3{-}CH(OH){-}CH_3} + H_2SO_4$$

The crude alcohol is separated by distillation and purified by chemical treatment and rectification.

Physical Properties of Isopropyl Alcohol.—The rectified alcohol is obtained in the form of a constant-boiling mixture containing 91 per cent. of alcohol and 9 per cent. of water, by volume. This mixture boils at 80.4° C., and has a specific gravity of 0.819 at 15.6° C. Thus, like ethyl alcohol, isopropyl alcohol cannot be concentrated beyond a certain point by simple distillation. It is, however, much easier to dehydrate than is ethyl alcohol, a short digestion with excess of dry caustic soda and subsequent distillation giving a practically anhydrous alcohol, boiling at 82.4° C., with a specific gravity of 0.789 at 15.6° C.

The isopropyl alcohol now marketed is a colorless liquid having a somewhat bitter taste and a characteristic alcoholic odor, different from that of ethyl alcohol, but pleasant and free from the foreign odors of the crude product. It is miscible in all proportions with water but may be salted out by saturating the solution with sodium chloride or other salts or with sodium hydroxide.

Pharmacology of Isopropyl Alcohol.—The pharmacological properties of this alcohol have been studied by Dr. David I. Macht, of Johns Hopkins University, and by Professor R. Burton-Opitz of Columbia University.

Dr. Macht found[1] that, when injected intravenously into cats, isopropyl alcohol is twice as toxic as ethyl alcohol, four-fifths as toxic as normal propyl alcohol, and one-fourth as toxic as benzyl alcohol. Comparative experiments on the action of various alcohols on the isolated hearts of frogs, and on isolated plain muscle (pig's ureter) gave results indicating the same order of toxicity as that shown by intravenous injection.

Rats were exposed to air saturated with the fumes of various alcohols. Methyl alcohol killed them in one or two days, while ethyl and isopropyl alcohols, during several days' exposure, produced no apparent injury. Furthermore, no subsequent blindness or defects in vision resulted from the inhalation of isopropyl alcohol vapor, in contrast to the well-known results of methyl alcohol poisoning.

Professor Burton-Opitz performed[2] a series of varied experiments, including the following:

Fifty cc. of isopropyl alcohol was administered by mouth to a dog weighing 6.5 kilos. Symptoms of serious muscular incoordination and some gastric disturbance resulted. The dog could walk normally the next day, and recovered completely the third day. Similar results followed the administration of the alcohol by stomach tube in amounts of about 10 cc. per kilo body weight.

Isopropyl alcohol applied to open wounds in concentrations up to 50 per cent. allowed healing by what appeared to be normal granulation. Isopropyl alcohol possesses healing properties similar to those of grain alcohol, so far as this can be tested on dogs.

Small quantities of isopropyl and ethyl alcohols, in concentrations varying from 10 to 100 per cent., were injected into the jugular vein and instilled into the conjunctiva, respectively. In both cases, the effect of isopropyl alcohol was approximately the same as that of ethyl alcohol.

The experience of members of this department[3] over the last two years substantiates, so far as it goes, the findings of the investigators just mentioned. Isopropyl alcohol has been employed, from

[1] A Toxicological Study of Some Alcohols, with Especial Reference to Isomers. *Jour. Pharmacol. & Experim. Therapeutics,* XVI, 1 (August, 1920).

[2] Unpublished communication, abstracted by Grant in a paper on Isopropyl Alcohol and its Physiological Properties, from the Perfumer's Standpoint. *American Perfumer,* XVI, 334 (October, 1921).

[3] Grant, *loc. cit.*

time to time, in lotions for chapped hands or after shaving, in liniment, in liquid soap and in antiseptic solutions for the throat. It has often been used undiluted to wash the hands, to cleanse small wounds, and to dry and harden the skin of the hands when swollen by hot water and alkali. One of the writers has repeatedly taken sponge baths from head to foot in isopropyl alcohol of about 50 per cent. concentration. In no case has any injurious effect been noted.

Large samples of isopropyl alcohol have been distributed during the past year to nurses and hospitals, and used, under medical supervision, for alcohol rubs on a number of patients. No untoward effects have been reported.

In an intensive experiment carried out under the supervision of Dr. J. M. Sinclair, of the Medical Department, Standard Oil Company (N. J.), five volunteers wore bandages saturated with undiluted isopropyl alcohol covering an area of about 60 square inches on the forearm, for from three to seven hours daily for four successive days, a total of 21 hours for each man. No harmful effects, either local or systemic, were experienced.

In view of the foregoing observations, it may be concluded that isopropyl alcohol is sufficiently non-toxic to be safely employed in external and oral medication, at least.

USES OF ISOPROPYL ALCOHOL.

The general similarity of this alcohol to ethyl alcohol suggests a variety of uses, many of which have not yet been investigated, owing to the fact that isopropyl alcohol has not been made on a sufficiently large scale. These applications may be broadly divided into uses of the alcohol as such, as a solvent, and as a source of chemical derivatives.

Uses of the Alcohol as Such.—As a dehydrating agent, isopropyl alcohol will doubtless be useful in chemical and biological work and in photography. It may be used for drying nitrocellulose, sugars, starches, proteins, gelatin and animal or vegetable tissues, for dehydrating histological specimens, and for cleaning and drying photographic prints and films. A great advantage is the ease with which it may be obtained anhydrous, in contrast to ethyl alcohol.

Isopropyl alcohol is now used, in considerable quantity, as a

"key denaturant" for ethyl alcohol in Formulas 39, 39A and 40 of the United States Bureau of Internal Revenue. These are formulas for specially denatured alcohol used in perfumes and barbers' supplies, and contain certain solid substances in solution which render them impotable. The isopropyl alcohol, which boils at nearly the same temperature as ethyl alcohol, cannot be separated from it by distillation, but will remain in it if a fraudulent rectification for beverage use be attempted, and can be detected by appropriate tests.

As a surgical antiseptic, isopropyl alcohol has already proved valuable, as has been noted above. Other uses of medical interest are those as an antidote for phenol burns, as a sterilizing medium for ligatures and instruments, and as a preservative for anatomical and pathological specimens.

Uses for which isopropyl alcohol is adaptable are as a filler for thermometers, thermostats and compasses, and as an "anti-freeze" in automobile radiators.

Isopropyl Alcohol as a Solvent.—In some cases, isopropyl alcohol has proved to be a superior solvent to ethyl alcohol. There is sometimes a striking difference in the solvent properties, for a given substance, of the common 91 per cent. and the anhydrous isopropyl alcohol. Perhaps the most striking difference between ethyl and isopropyl alcohols is in the relative ease with which isopropyl alcohol can be "salted out" from an aqueous solution.

Applications of this alcohol as a solvent include the following:

In the manufacture of fine organic chemicals and synthetics, for extracting pure substances from mixtures, especially from alkali fusions, or for dissolving out impurities from insoluble substances. Also as a recrystallizing solvent. Examples: Benzoic acid, salicylic acid, sodium benzoate, beta-naphthol, saccharine, acetanilid and other antipyretics, benzaldehyde, salol, benzidine, creosote carbonate, veronal, benzonaphthol, dyes, heliotropin, alkaloids, santonin, aloin, tannin, coumarin, saponins, hydroquinone, and numberless others.

In the preparation of solid medicinal extracts, plant principles, oleoresins, etc.—The official preparations must, of course, be extracted by ethyl alcohol, ether or acetone, as the case may be. There is a large field, however, for non-official products of this nature, for use in proprietary remedies, flavoring compounds, etc.

For the manufacture of such products, isopropyl alcohol has the advantage over denatured grain alcohol of containing no poisonous or offensive ingredient necessitating scrupulous elimination of the alcohol from the product before use. In cases where its solvent power is comparable, it may replace ether and acetone, thus reducing the fire hazard, as well as the loss by evaporation. Examples are: Oleoresins of capsicum, cantharides, ginger, cubeb, aspidium, vanilla, orris, labdanum, opoponax, oak moss, pepper, lupulin, etc.; agaricin, podophyllin; resin of scammony, extracts of jalap, cannabis indica, gelsemium, hydrastis, nutgalls, cola nuts, etc.

As a solvent for medicinal substances for external medication, isopropyl alcohol should be extremely useful, obviating the use of poisonous or offensive denatured alcohol, of expensive medicated alcohol and of pure ethyl alcohol which is costly and always liable to be diverted for illicit use. Non-official tinctures or spirits of the following drugs may be made by its use: Benzoin, tolu, arnica, cantharides, capsicum, pyrethrum, camphor, myrrh, larkspur, mustard, cocculus indicus, rosemary, witch hazel, etc. It should also be useful in the compounding of liniments, collodions, alcoholic lotions and antiseptic varnishes for burns and in the purification of oxgall and the extraction of lecithin, prolamines, gaduol, etc. An addition of 12 per cent of isopropyl alcohol to crystallized phenol causes liquefaction, and the resulting liquefied phenol will mix easily with both oily and aqueous liquids. Notwithstanding its slightly unpleasant taste, isopropyl alcohol is applicable to certain types of antiseptic solutions for oral and nasal use. Solutions made with it can also be used for medicating surgical dressings.

In cosmetics, the possibilities of isopropyl alcohol are considerable. As a solvent medium, it may be used in perfumes, toilet waters, bay rum, hair tonics, dandruff cures, bandolines and brilliantines, shampoo liquid or jelly, liquid rouge, and all kinds of cosmetic lotions, as well as in "theatre sprays."

In chemical, biological and medical laboratories, isopropyl alcohol is also a useful solvent. It can be used for immiscible solvent extraction from aqueous solutions or from petroleum ether solutions, being thrown out from the former by salts or alkalies and from the latter by water. It can be used for reagent solutions such as phenolphthalein, methyl orange, guaiac, phloroglucin, dimethyl glyoxime, picric acid, etc., etc., as well as for standard soap solution for water

testing and, with an addition of 20 per cent. of pure methyl alcohol, for standard alcoholic alkali. It may be used in staining solutions for bacteriological and pathological work. Its use in preserving biological specimens and in dehydrating tissues and drying precipitates has already been established.

In the nitrocellulose and cellulose acetate industry, isopropyl alcohol may serve to some extent as a "latent" solvent, or as a solvent for camphor or camphor substitutes, in the preparation of plastics, "dopes" and lacquers, films and collodion.

As a resin solvent, isopropyl alcohol will undoubtedly be useful. It is a good solvent for shellac, distinguished by the fact that it dissolves shellac wax as well as resin, giving a more viscous varnish than ethyl alcohol. It is also a good solvent for sandarac and mastic resins, for common rosin and for "bush kauri," and a useful partial solvent for elemi, copal and dammar. Its non-poisonous character gives it a great advantage over denatured ethyl alcohol in spirit varnishes which are used for food containers or which are allowed to evaporate in closed rooms where the occupants must breathe the vapors. Sanitary can lacquers, brewers' vat varnish and artists' crayon fixatif may be mentioned in this connection. Isopropyl alcohol resin solutions may eventually find use in the manufacture of transparent paper, "window" envelopes, tracing paper, stencil papers, plastic molded insulation, soldering fluxes and sealing wax, fireworks and matches and wood filler.

Other applications of isopropyl alcohol as a solvent may be briefly enumerated: In wood stains and other special dyeing; in flavoring extracts, including tobacco flavors; in the extraction of glycerine from distillery residues; in varnish and paint removers; in liquid soap; in disinfectant and deodorant solutions and insecticides; and in "dry cleaning."

Isopropyl Alcohol as a Precipitant.—An important use for isopropyl alcohol will probably be that of a precipitant for proteins and peptones, for pepsin, trypsin, pancreatin, rennin, papain and other enzymic ferments, sugars, dextrins, gums and mucilages, soluble starch, silver protein compounds, glycerophosphates, etc.

Derivatives of Isopropyl Alcohol.—The availability of isopropyl alcohol in sufficient quantity has made possible the preparation

and study of a large number of derivative compounds hitherto unknown or existing only as laboratory specimens.

Isopropyl Acetate is a fragrant liquid, boiling at 88.5-89° C. (even with very carefully purified material the boiling point of 93° given in the literature could not be confirmed). It has a specific gravity of 0.877 at 15.6° C. This ester is, as might be expected, an excellent nitrocellulose solvent, evaporating quickly, but not so quickly, it seems, as to cause the condensation of water from a moist atmosphere. It is accordingly, useful in pyroxylin lacquers.

Isopropyl Chloride is a pleasant-smelling, non-corrosive liquid with a boiling point of 36.5° C. and a specific gravity of 0.866 at 15.6° C. It is an excellent solvent of fats, and, while it can take fire, is extinguished with great ease. It can replace carbon disulphide and petroleum ether to some extent in the fat extraction industry, besides serving as an intermediate product for many synthetic compounds. It may also be used as a refrigerant in certain types of machines.

Di-isopropyl Ether is a liquid with a sweetish and somewhat camphoraceous odor, boiling at 68.2-68.7° C. and having a specific gravity of 0.732 at 15.6°C. Its properties have been, as yet, very little investigated.

Chlorination Products of Isopropyl Alcohol. The chlorination of isopropyl alcohol gives rise to a series of chlorpropanes and chloracetones, as well as traces of other compounds. The former, mainly 1, 2 and 2, 2 dichlorpropanes, are of value as non-inflammable solvents, boiling at 97-98° C. and 69.7° C. respectively. Protracted chlorination of the chloracetones gives mainly pentachloracetone, a substance capable of yielding a number of interesting and valuable products by various synthetic reactions.

Acetone is obtained by the catalytic oxidation of isopropyl alcohol, in good yield. In times of acetone shortage, this method will supplement the existing ones to good advantage.

Isopropyl Esters of formic, butyric, valeric, benzoic and salicylic acids have been made and may find application in the perfume and essence industry.

Isopropyl Aniline and the *Isopropyl Toluidines* have been prepared and undoubtedly will be useful as dye intermediates.

There are, of course, scores of other derivatives of isopropyl alcohol which may, in one way or another, prove valuable.

It is not often that one is able to record the entrance into the chemical industries of a basic substance having such wide possibilities as has isopropyl alcohol.

THE EFFECT OF HEATING COCCULUS INDICUS IN RELATION TO CHEMICAL IDENTIFICATION OF PICROTOXIN.*

By D. S. Kabayao.

Being familiar with the practice of fish poisoning in the Philippines, by means of the roasted berries of "Lagtang" (Cocculus Indicus; Anamirta Cocculus) the active principle of which is picrotoxin, I undertook to perform a series of experiments on the process of extraction and various means of manipulation, to find whether or not the chemical tests for the detection of picrotoxin would hold good under different tests from the medico-legal standpoint, as well as the significance of the practice of preparation of the fish poison and its bearing on chemical and poisonous properties.

It may be of interest to have stated here the process formerly in common but illegal use in procuring fish by "Lagtang" poisoning. The berries (kernels) are roasted in some suitable container over a fire, the object of which is apparently to facilitate pulverization. The roasting results in browning of the kernels similar to roasted coffee. The roasted and finely ground "Lagtang" is mixed with meat or other material also finely ground and the mixture thrown into streams or into sea water. The fish, poisoned by eating this material, are gathered and used for food. It is interesting to note that people eating such fish are rarely poisoned, at any rate such possibilities have not deterred the continuation of such a practice.

The extraction of the berries for this study was made by a modified Stass-Otto method as follows:

1. *Preparation of the Material.*—A handful of the kernels placed in a nickel crucible was roasted over a free flame. The roasted berries were then ground in much the same way as is coffee.

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2. *Extraction.*—To this crude material was added acidified water (tartaric acid being used) and then the mixture was boiled for ten to fifteen minutes; it was then filtered and the filtrate evaporated to a paste.

3. *Removal of Salts, Proteins, Fats.*—To the evaporated solution, alcohol (95 per cent.) was added to extract the toxic portion. Filtered.

4. *Removal of Resins, Fats, Etc.*—The alcoholic solution was diluted with an equal volume of water. This precipitated resins and fats. The filtrate was evaporated to near dryness to remove the alcohol. The filtrate was allowed to evaporate to about two-thirds of the original volume and cooled. On cooling, white, prismatic, needle-shaped crystals were formed. Two cubic centimeters of the aqueous solution were injected into the dorsal lymph sac of a frog and the typical picture of picrotoxin convulsions was obtained.

Using commercial picrotoxin as a control, the Langley brick-red color reaction test[1] for the detection of picrotoxin was performed. About 1 mg. of both picrotoxin and the extracted substance were separately tested for the Langley reaction. The poison extracted from the roasted berries gave a negative reaction. Picrotoxin[2] reduced Fehling solution while the extracted berry poison did not.

Another experiment was conducted using the drying oven (104° C.) for drying the berries. The method outlined above was used for extraction. After having secured the extracted crystals, Langley's reaction test was performed using picrotoxin as control. Each gave a positive reaction. Both the aqueous solution of the extracted poison and commercial picrotoxin gave similar physiologic reactions in the frog. Fehling's reduction test was positive in both commercial picrotoxin and the substance extracted from the cocculus. Suspecting the changes above described to be due to the heating of the berries, similar experiments were performed on commercial picrotoxin using the paraffin bath for regulating the temperature. The melting point[3] of picrotoxin is given as 203° C. It was heated above its melting point but not enough to char the substance. It became deep

[1] *Am. Jour. Med. Sciences and Arts*, 1862, xxxiv (Series II), 109.
[2] *Am. Jour. Med. Sciences and Arts*, 1862, xxxiv (Series II), 109.
[3] *U. S. Dispensatory*, 18th Ed. 1899, 1031.

red in color and was of resinous consistency on cooling. Extraction was made, using acohol as the solvent; then the solution was decolorized with animal charcoal and set aside till crystals formed. Injection of an aqueous solution of these crystals into the frog produced typical picrotoxin convulsions. Langley's test reaction was negative as was also the Fehling's reduction test.

Something must be responsible for this change in the chemical reactivity of picrotoxin as indicated by the negative Langley reaction and a negative Fehling reduction test when heated to about 300° C. Picrotoxin dissolved in 20 per cent. sodium hydrate and precipitated by concentrated hydrochloric acid, does not answer the Langley tests, but still retains its toxic principle.[4] It is possible that the action of heat is similar in chemical changes produced. To determine whether or not oxidation was the factor causing changes in chemical properties subsequent to heat or action of chemical agents, heating was done in an atmosphere of hydrogen. The results were the same, indicating an intramolecular rearrangement due to heating at a high temperature and not likely due to oxygen of the air causing oxidative changes.

The significance of this method of preparation of the fish poison and its bearing on chemical and poisonous properties is evident, for as practiced in the Philippines, picrotoxin poisoning may occur by eating the fish poisoned with the drug, which having been heated fails to give positive reactions to the chemical tests.

Owing to great uncertainty as to the chemical structure of picrotoxin,[5] the type of action produced by heat or chemical agencies in changing the chemical characteristics cannot be more than hypothetically stated.

CONCLUSION.

In view of the experiments above described the commonly recognized chemical tests for the identification of picrotoxin (of anamirta cocculus) cannot be depended upon when, as is the custom, the berries have been roasted over a free flame. Such a preparatory roasting of the substance in some way changes the chemical charac-

[4] *Am. Jour. Med. Sciences and Arts*, 1862, xxxiv (Series II), 109.

[5] *Arch. exp. Path. u. Pharmak.*, 1911, lxiv, 407; *Zent, Bioch. Bioph.*, 1912, xiv, 827; Abderhalden, *Biochemisches Handlexikon*, Band vii, 254.

teristics without any certain diminution or alteration of its toxic properties.

In closing I wish to express my gratefulness to Dr. A. L. Tatum, of this department, under whose direction this work was performed.

BOTANICAL SOURCE OF THE COLA NUT OF COMMERCE.

By O. A. Farwell.

I. H. Burkill, in "Notes on Cola Trees in the Economic Garden, Singapore," in *The Gardens' Bulletin* II, 74-86, Fig. 1, 1918, gives a history of the Cola trees in the garden, where they were introduced in 1879, their growth and production. He adopts the nomenclature of Chevalier and Perrot as expounded by them in *"Vegetaux utiles de l'Afrique tropicale francaise,"* VI, 1911. They claim that the *Sterculia acuminata* Beauv. of Benin is a small bushy tree seven or eight feet in height and does not produce the Kola Nut of Sierre Leone, which is the Kola of commerce, or but a very small part of it; that the tree that produces the larger part of the Kola Nut of Sierre Leone is forty feet in height and is the *Sterculia nitida* Vent. The former produces Kola Nuts with three or more cotyledons and the latter those with only two cotyledons. Under the genus *Cola* these species are known respectively as *Cola acuminata* (Beauv.) Schott and Endl. and *Cola nitida* (Vent.) Schott and Endl. Three varieties of the latter are given: var. *alba,* var. *rubra* and var. *mixta.* The fruit and seeds are illustrated and fully described. The active principles and chemical composition are given and elaborate notes on the trade, cost of drugs and chemicals during the war, cultivation and yields and properties.

Bichea Stokes Bot. Mat. Med. 2: 564, 1812, is the oldest generic name for these species and therefore *Sterculia nitida* Vent. Jard. Malm. sub. t. 91, 1804, should be *Bichea nitida* (Vent.), Farwel, n. comb.

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OSYRIS ALBA SUBSTITUTE FOR SCOPARIUS, N. F.

By Oliver Atkins Farwell.*

Some eight or nine years ago this European member of the Sandalwood family made its appearance on the American drug market under the name of Broom Tops. It is again cropping up. It bears a strong general resembance to the official drug and will easily pass muster for it either as a substitute or as an adulterant. Both are of about the same shade of green when fresh, but Scoparius fades dark brownish green, while Osyris is usually of a pale brownish or yellowish green. The branches are leafless and flowerless, but occasionally have a few berries. The larger branches or stems are evenly many striate instead of five-winged and the small branchlets about nine-angled, but none of the angles sufficiently prominent to be called winged. In Scoparius the buds are placed in the channels between the wings while in Osyris the angle begins at the middle of the bud, forming a keel on its dorsal side and runs down the stem; the bud thus appears to be on the angles instead of in the channels as in Scoparius. The larger branches and likewise the smaller are about of the same thickness and length as the corresponding ones of Broom Tops. The wood and the ground drug are white and the latter is very readily distinguishable by color from ground Broom Tops, which is of a yellowish color. A careful inspection of the crude drug, however, should at once detect this adulterant or substitute by the following characters: (1) the stems are many striate instead of five-angled or winged; (2) the buds are at the apex of an angle, which forms a keel on the dorsal side of the bud, instead of in the channels between the angles; (3) the wood is white instead of yellowish.

FOOD FROM THE AIR.†

By Henry Leffmann, A. M., M. D.‡

It is a primary principle of biology that plants are intermediate between animals and the earth. It is the plant that works up the

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†Abstract of a lecture delivered as one of a series of popular lectures at the Philadelphia College of Pharmacy and Science.
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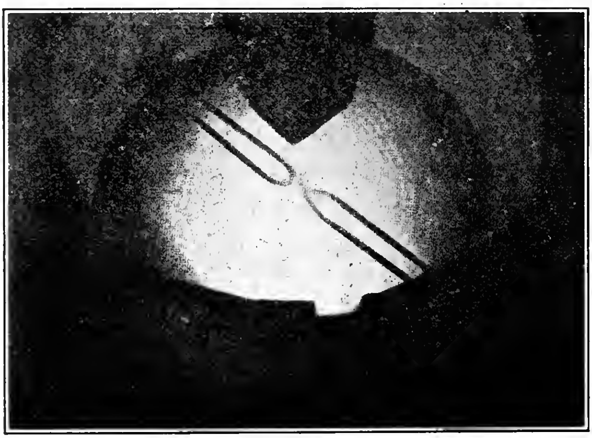
inorganic materials, carbon dioxide, water, phosphates and nitrates, into new forms, principally proteins and carbohydrates upon which herbivorous animals feed, convert into other substances, and become in turn the food of carnivorous animals. After death, all organisms are converted into inorganic materials and the cycle of rebuilding is resumed.

It is obvious, therefore, that the maintaining of human life is absolutely dependent on the maintaining of vegetable life, so that in the last analysis, the land is the only source of wealth. The last hundred years have witnessed an enormous growth of population,



Arc of the Birkeland-Eyde Furnace. From *Trans. Farad. Soc.*, 1906, 2, 98. *Courtesy of the Wagner Free Institute of Science.*

and its concentration in cities at an increasing ratio. The area of land under cultivation has not increased in the ratio of the increase of those dependent on it, who are so placed that they cannot increase food production. Although some of the advance in the cost of meat and dairy products is due to trust-control, aided by methods of cold storage, both for withholding perishable articles and facilitating transportation to other countries, these conditions are not alone to blame. There is a real *relative* scarcity.

High fertility of land depends on the presence of certain classes of inorganic substances and on certain types of living organisms. While much remains to be determined as to the best conditions of plant growth, it is now pretty well established that the plants which

form the food of man and of the herbivorous animals eaten by him, require compounds of phosphorus, potassium and nitrogen. A few of the compounds of these elements are especially adapted for plant growth, and it is the endeavor of the agriculturist to obtain soils containing these substances, or to add them if lacking. Phosphates and potassium compounds are found in many parts of the world, but the supply of nitrogen compounds is not so widely distributed, and so far as nitrates are concerned, which are the best forms for plant nourishment, the world has been for some time relying on deposits on the west coast of South America, commonly known as the

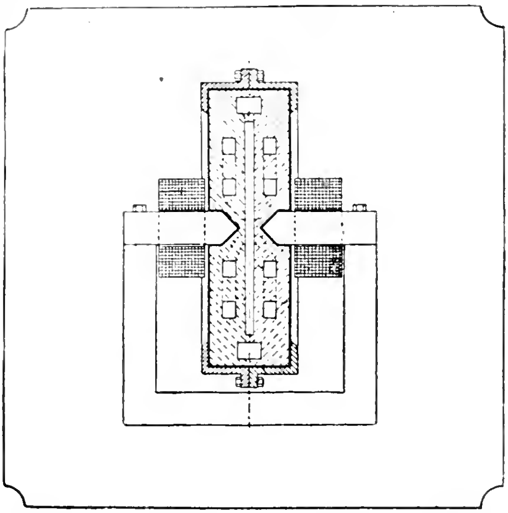


Diagram of Birkeland-Eyde Furnace. *Trans. Farad. Soc.*, 1906, **2**, 98. *Courtesy of the Wagner Free Institute of Science.*

"Chili nitrates." These deposits are extensive, but not inexhaustible, and experts have been active of late to secure a source of nitrogen in form fit for plant life that may render the world independent of local deposits. Not only is this question related to plant life, but many important products of modern industry depend on nitric acid and ammonia, and it is desirable to safeguard these industries against a lack of raw material. Dye-stuffs, many medicinal substances and most high explosives require for their production nitric acid.

The great and practically inexhaustible supply of nitrogen is the atmosphere, which contains about four-fifths its volume of the ele-

ment, but it is in the free state, and, under ordinary conditions, free nitrogen is very difficult to bring into combination. Under some natural conditions, a utilization of nitrogen occurs that has much value in farming, but no application to the industrial question. Many plants of the bean family,—clover, for instance,—develop upon their roots minute tubercles, which are found to be accumulations of bacteria, that convert nitrogen into compounds that the plant can take up. Thus, a mutual relation is established, termed "symbiosis," which has been practically applied to increasing the fertility of soils. It has long been known that clover plowed in increases the productive power of a soil. The reason is known, and benefit results from inoculating certain seeds with cultures of these bacilli before planting.

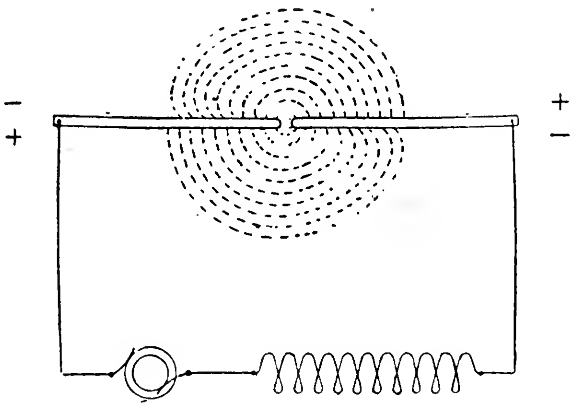


Diagram of Arc of Birkeland-Eyde Furnace. *Trans. Farad. Soc.*, 1906, **2**, 98. *Courtesy of the Wagner Free Institute of Science.*

For the industrial conversion of the free nitrogen of the air into compounds, several methods have been devised. The procedure is called "fixation."

Fixation of Nitrogen by Oxidation.—The simplest method in principle for converting nitrogen into useful compounds is direct union with the oxygen in mixture with it in the air, but this is impossible as far as known under ordinary conditions. The affinities of both elements are too low. Under the influence of high tension electric discharges oxygen acquires a much higher affinity, though only a very small percentage of the total volume is affected. These

effects were noted in the eighteenth century by Cavendish and Priestley. Methods of producing electricity were long imperfect and expensive, but the modern methods are capable of application on a commercial scale and installations for the production of nitrogen oxides, especially nitric acid, have been made in several places. The installation is essentially that of an arc lamp with the carbons so arranged that a flaming discharge is produced. One of the successful forms is the Birkeland-Eyde furnace, which uses an alternating current of high voltage surrounded by a constant magnetic field. This magnetic influence spreads out the arc in a fan-shape so that it may be six feet in diameter. A plant of this type was operated about twenty years ago at Niagara Falls. Under ordinary commercial conditions the cost of sodium nitrate from Chili is such as make it not profitable in this country to use such a process. Other forms involving the same general principles have been invented and operated. Notwithstanding the simplicity of the principles on which the electric current acts, the practical operation involves difficulties. The temperature must be carefully regulated, as the reaction is of the class called "reversible," that is, under certain conditions the compounds will be decomposed as fast as formed. Where water-power is available, the process can be worked with success. The action of the arc, however, is not entirely due to its heat.

Fixation of Nitrogen by Absorption.—Calcium carbide produced by the action of finely divided carbon upon lime, under the influence of the electric arc, has been a commercial product for many years for the manufacture of acetylene. When it is heated strongly in a current of nitrogen, direct combination takes place, with the formation of calcium cyanamide and some free carbon. Calcium cyanamide can be used directly as a fertilizer, and as it contains slightly more nitrogen in proportion to weight than sodium nitrate, it has been much used. In the manufacture of calcium cyanamide precautions must be observed to avoid dangerous explosions, but these need not be detailed here.

In the case of the union of nitrogen and oxygen under the influence of the arc, the action is what is called "endothermic," which means that it is attended by the absorption of heat, but the formation of cyanamide is an "exothermic" reaction, *i. e.*, attended by the giving out of heat, and care must be taken that the mass does not

become too hot or the nitrogen will be driven out. Calcium cyanamide has been marketed under the trade name "nitrolin." The cyanamide process requires nitrogen in a fairly pure state, but in the direct-arc process the raw material is air, which is in unlimited supply. The fertilizing properties of the cyanamide are due largely to its ready conversion into ammonia under the influence of moisture and the bacteria of the soil. A large plant for the production of this substance was erected by the United States Government at Muscle Shoals, Alabama, during the late war.

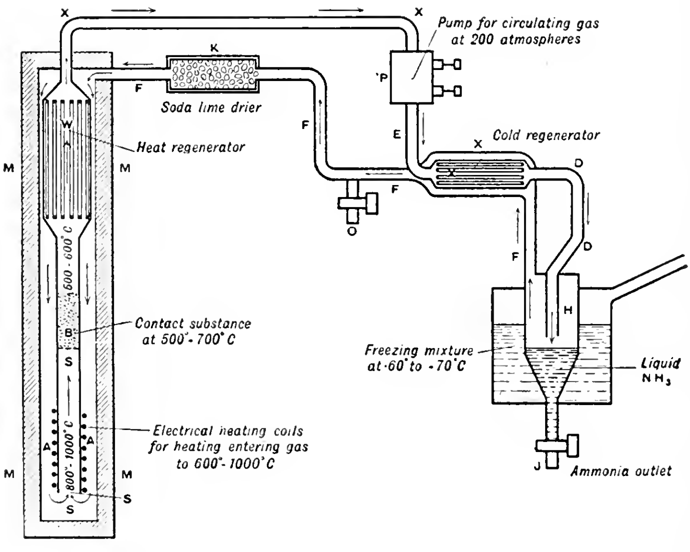


Diagram of Haber-Le Rossignol Installation. Martin and Barbour, Industrial Nitrogen Compounds. 54. *Courtesy of the Wagner Free Institute of Science.*

Fixation of Nitrogen as Ammonia.—Many sources of ammonium compounds exist. They are produced in the putrefaction and destructive distillation of organic materials. As these cases do not come within the scope of fixation of atmospheric nitrogen they will not be further considered. Ammonium compounds can be transformed into many other nitrogen compounds including nitric acid, hence their production is desirable, and a great deal of attention has been given to the utilization of the immense stores of nitrogen in the atmosphere. The process that has been most extensively applied is

that in which hydrogen and nitrogen are compressed at high temperatures in strong cylinders. It is generally called the "Haber process," from the name of the principal inventor who lately received the Nobel prize for his work in this line. The name of Le Rossignol is also associated with it, as the two published in 1913 a paper on the subject which marks the beginning of the application. The pressures and temperatures required are very high, which renders the procedure somewhat dangerous. The German chemists, who have most extensively employed the method, resorted to the expedient of sinking the cylinders in the ground as additional strengthening. The combination of the two gases cannot be brought about by mere contact under any pressure or temperature. It is found that a third substance is required, but this need be present in only small amount and does not take permanent part in the action, so that it can be used repeatedly. This kind of action, of which many examples are now known, in which a substance acts by its presence, is termed catalysis and the substance is termed a "catalyst." The inventors found the number of substances available as catalysts in this process to be quite limited, and one of the most active to be very rare and expensive. They found, however, that certain uranium compounds would act. On the basis of their work, the Germans constructed a large plant for the manufacture of ammonia and the conversion of it into other important nitrogen compounds. As large amounts of heat and power are not required the process is capable of exploitation in many parts of the world. It has, however, found its most extensive development in Germany, to which it was of immense service during the war. From information obtained since the close of the war, it seems probable that if the Germans had not had this method in active and extensive operation, they would have been obliged to suspend the war early in 1915, as the supply of Chili nitrates would have been cut off by the British blockade. They were able, however, to secure within their own territory all the nitric acid needed for the manufacture of dyes and munitions.

The main German installation was at Oppau near Ludwigshafen on the Rhine, operated by the Badische Anilin and Soda Fabrik. It appears from investigations made by an American officer that during the year preceding the signing of the armistice, this plant had fixed 90,000 tons of nitrogen, and that in 1916 the entire German

equipment fixed 400,000 tons. The cost of the Oppau plant was over $25,000,000.

In 1921 a terrible explosion occurred at this plant by which many persons were killed and part of the plant and nearby houses wrecked. The cause of the explosion has remained in doubt. It is, indeed, not likely that the German chemists, even if they knew the cause, would take the world into their confidence.

The United States, during the war, started a small plant to manufacture nitrogen compounds by this method, but it seems that it did not get beyond the experimental stage. It was located at Muscle Shoals, Alabama, with the cyanamide plant.

Other processes for nitrogen fixation have been devised, among which is that of Bucher, in which air is passed over coal or coke mixed with an alkali and with finely divided iron as a catalyst. A cyanide is formed, which by simple methods may be converted into other nitrogen compounds.

There seems to be no doubt that the United States should establish at once a large plant for nitrogen fixation by some approved process, in order that we may be independent of the Chili supply, which apart from the possibility of its exhaustion, might be cut off from us in case of war.

ABSTRACTED AND REPRINTED ARTICLES

RECENT ADVANCES IN PLANT CHEMISTRY.*†

[Abstract]

By R. W. Thatcher.§

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The study of the chemistry of plant life is one of the most recent phases of the development of the science of chemistry. Economic interests have always stimulated metallurgical research and

*Reprinted from the *Jour. Ind. and Eng. Chem.*, April, 1922.

†Presented before the Rochester Section of the American Chemical Society, Geneva, N. Y., October 1, 1921.

§Director of Experiment Station.

studies in connection with processes of industrial manufacture of organic compounds. Interest in pubic health problems has been a powerful stimulus to the study of the chemistry of physiological and pathological processes of animal life. But similar studies of the chemistry of plant life have been, for the most part, left to the botanists or to an occasional biochemist who has had as his impelling motive a keen interest in the works of Nature as manifested in the growth of plants. Even so-called "agricultural chemists" have devoted most of their energies to the problems of supplying anergic foods to plants in the form of fertilizers, or to the problems of animal nutrition, or to the inspection service in connection with the regulation of the sale of agricultural products to or from their ultimate consumer.

Recently, however, there has appeared in the plans and the writings of a few biochemists the idea that the study of the synthetic activities of plants offers a fascinating and fruitful field both for scientific inquiry and for economic development.

Undoubtedly the most serious handicap which biochemists have had in their attempts to study or duplicate the chemical processes which take place in cell protoplasm lies in the fact that they have thus far been compelled to work with mixtures of reagents in solution, contained in beakers, test tubes, etc., in which ionization and diffusion make a uniform chemical change throughout the entire reacting mass practically unavoidable. Recent advances in our knowledge of the colloidal condition make it plain, however, than even in so small a mass as the protoplasmic contents of a single cell there are thousands, if not millions, of colloidal compartments, separated from each other by membranes of variable and perhaps constantly varying permeability, in which a great variety of chemical changes may go on independently of each other.

It seems to be, therefore, that the first requisite for up-to-date study of the chemistry of living things is a recognition of the *structure* of the cell as an essential factor in its synthetic operations, and that the first advancement toward an understanding of and possible duplication of the cell synthesis will require the successful reproduction of a colloidal mass having similar structure to that of cell protoplasm.

A proper mental picture of the organization and activity of

a plant cell is suggested by the figure of a well-organized chemical factory, with the different transformations which are involved in the whole process going on in different parts or rooms of the factory, with the raw materials systematically transported from one room to another as they are needed to keep each step in the whole process going at the proper rate; and with all the different parts of the whole factory working in smooth co-ordination with each other.

The raw materials for this factory are the mineral matter and water coming from the soil and the gases of the atmosphere; the intermediates are the simple carbohydrates and amino acids; and the finished products comprise all of the varied compounds which are the results of cell protoplasmic activity and which are used by the plant for its nutrition, growth or reproduction.

The researches of botantists and chemists in the past have dealt with the nature of the compounds and the chemical changes which are involved in each separate process of the factory's operation. The principal problem now is to learn the nature and method of superintendence of the factory whereby its operations are automatically regulated and altered so as to provide the proper output of all the varying products of the factory to meet the needs of the whole plant. We are as yet almost wholly in the dark concerning the regulatory agencies which control the rate and character of the synthetic processes of cell operation. We call these regulatory agents catalysts, or enzymes, but as to what they are and how they act we know very little.

Furthermore, we have absolutely no idea of the methods of intercommunication and of recognition of supplies and needs of raw materials or finished products whereby the factory output is varied in kind or quantity to meet the needs of the growing plant. We say, more or less empirically, that "hormones" stimulate certain cell activities. But what are hormones, and how do they happen to be in the right place and at the right time to start the factory operation as it is needed? We speak glibly of "inhibitors" which slow up or stop any given process when its products accumulate in quantities unsuitable for the proper functioning of the plant organism; but we know little of their nature or origin.

In my opinion, therefore, the most significant contributions to our knowledge of the chemistry of plant life in recent years are those which deal with the phenomena associated with the colloidal conditions of matter and with the catalysts, stimulants, and inhibitors which serve to regulate both the direction and the velocity of the chemical reactions which, taken as a whole, constitute the vital phenomena.

I regard as one of the most promising fields of investigation of plant chemistry the apparently simple, but as yet little understood, relation of water to the colloidal condition of organic materials. The recent preparation of an artificial gel which is so nearly solid that it can be cut into blocks with a knife and from which no water can be squeezed out, which yet contains less than 0.3 per cent. of solid matter, is an illuminating example of the possibilities of almost infinite dispersion and of the extent to which surface boundary phenomena may be brought into play in semisolid colloidal masses like that of plant protoplasm. The constant changes in concentration of dissolved solids by colloidal imbibition of water, and the protection of protoplasm against injury by extreme changes of temperature, as well as the adaptation of plant protoplasm to its environmental surroundings are all definite chemical phenomena which may well find their explanation in the water relations of the colloidal mass.

A further aspect of plant chemistry, the significance of which is easily apparent from the simile of the factory, is that chemical changes which are almost the exact antithesis of each other are going on simultaneously in every active plant organism, if not indeed in each individual plant cell. The synthetic production of complex organic compounds and the destructive oxidation of previously produced synergic foods to furnish energy for the synthetic processes go on simultaneously; just as, in any factory, there is consumption of fuel, wearing out of equipment, etc., during the process of manufacture of the factory output. This phenomenon, too, is readily understood on the basis of colloidal structure and emphasizes again the importance of recognition of this condition of matter as a necessary step in studies of protoplasmic activities.

IMPROVED METHOD FOR THE PREPARATION OF VITAMINE-ACTIVATED FULLER'S EARTH.*

By Atherton Seidell,

Technical Assistant, United States Public Health Service.

Since the discovery several years ago[1] that certain varieties of fuller's earth, particularly the variety from Surrey, England, exert a remarkable adsorptive power for the antineuritic vitamine, this reagent has been exclusively used as the first step in my attempts to isolate vitamine from brewer's yeast. For this purpose the fresh yeast was allowed to autolyze, and the resulting product was filtered. Fuller's earth was then added to the clear liquid and, after thorough agitation, the solid was removed by filtration and was washed and dried. The "activated fuller's earth" thus prepared, on account of its relative uniformity and exceptional stability, was believed to be the most favorable raw material for experiments on the isolation of the antineuritic vitamine.

The most unsatisfactory step in the process of preparing "activated solid" is the extremely slow and wasteful filtration of the autolyzed yeast. Numerous experiments were early made for the purpose of eliminating this very troublesome filtration, but improvements worthy of recommendation were not developed. Recently, however, by making use of an observtion of Osborne and Wakeman,[2] a substantial improvement in the method has been made and is now brought to the attention of persons interested in the more precise study of the chemical and physiological properties of the antineuritic vitamine.

It was demonstrated by Osborne and Wakeman that when fresh yeast is added to boiling water, acidified with 0.01 per cent. acetic acid, the yeast cells are disrupted, the protein is coagulated, and the vitamine is set free to enter the aqueous solution. This latter can readily be separated from the coagulated protein and insoluble material and is a very much more satisfactory solution for the adsorption of vitamine by fuller's earth than the very complex filtrate from autolyzed yeast.

*Reprinted from *Public Health Reports*, April, 1922.

[1] Seidell: *Public Health Reports*, 31, 364 (1916).

[2] Osborne and Wakeman: *Jour. Biol. Chem.*, 40, 383 (1919).

The advantages resulting from this modification are that the manipulations are greatly shortened and simplified and, what is of greater importance, a much better final product is obtained. The basis of the latter claim is that at least one of the interfering substances simultaneously adsorbed with the vitamine is almost, if not entirely, eliminated. This compound is adenine, which is a product of the autolysis and is present in the yeast filtrate and subsequently adsorbed by the fuller's earth. It is, however, not formed to an appreciable extent during the rapid heating of the fresh yeast according to the modified method, and consequently does not become an impurity in the final "activated solid."

The improved method for preparing vitamine-activated fuller's earth on a moderately large scale has been very satisfactorily carried out as follows:

Fresh bottom yeast, as obtained from the brewery, in quantities of 50 or more liters, is diluted with about an equal volume of tap water and heated, while being stirred, in a steam-jacketed kettle until the temperature reaches approximately 90° C. It has been found that if this temperature is exceeded, the mixture is apt to foam excessively and overflow the kettle. After about five minutes at 90°, the mixture is cooled to 50° or less, and the coagulated protein is removed by filtration.

The protein can be very effectively and expeditiously removed by means of a large Sharpless centrifuge. The protein remaining in the bowl of this machine is of cheeselike consistency and retains a relatively small proportion of the aqueous vitamine solution. This latter is a clear dark-brown liquid. English fuller's earth is added to it in the proportion of 30 grams per liter and the mixture is actively stirred for one-half hour or longer. It is then subjected to filtration or the solid may be removed more conveniently by means of the Sharpless centrifuge. The "activated solid" is finally washed with several changes of water and alcohol and then thoroughly dried to prevent subsequent growth of molds, which are very readily nourished by the minute amounts of organic material from the yeast solution, persistently retained by the "activated solid."

Samples of "activated solid" prepared by the above process were found to contain approximately 1.5 per cent. of nitrogen instead of slightly more than the 2 per cent. usually present in samples prepared by the original method from autolyzed yeast filtrate. The

content of antineuritic vitamine, as estimated by feeding experiments on pigeons, was found to be about twice as great as that of the product made by the original method. Complete protection of pigeons against loss in weight on a diet of polished rice, or restoration of such lost weight, was afforded in all cases by doses of 0.1 gram on alternate days. Doses of 0.05 gram prevented all but a very slight diminution in weight for many weeks.

From these tests it is evident that the protective dose for pigeons of 300 grams weight is under 0.1 gram; whereas with samples of "activated solid," prepared by the original method, adequate protection usually required doses between 0.1 and 0.2 gram. This, taken in connection with the lower nitrogen content and absence of adenine is ample evidence of the greatly improved character of the "activated solid" prepared by the new method.

PRODUCTION OF CASTOR OIL IN ARGENTINA.*

Trade Commissioner Geo. S. Brady, compiled from a report prepared by Carlos D. Girola for the Argentine Minister of Agriculture.

Castor oil is prepared from the seed of the "tartago" or castor-oil plant which has been grown in northern Argentina for many years. While the plant grows as far south as the 40th parallel, its practical cultivation is limited to that part north of the 30th parallel. From 3000 to 4000 hectares (1 hectare equals 2.47 acres) are cultivated each year, distributed approximately as follows among the Provinces and Territories: Chaco Territory, about 2000 hectares; Entre Rios, 1000 hectares; Corrientes and Tucuman, each less than 500 hectares; while there are small quantities produced in Misiones, Formosa, Salta, Sante Fe and Santiago del Estero.

The variety cultivated in Argentina is designated as "ricino colorado" or red castor bean (*Ricinus sanguineus*). In the Chaco Territory the seed is sown in August, and ripens within four to six months after the planting. Calculations are based on a production of one metric ton (one metric ton equals 2204.6 pounds) of seed per hectare, but a crop of two tons is often produced, and a yield as

*Through *Commerce Reports*, of these changes modifies the principles upon which the proposed method rests.

high as three tons per hectare has been recorded in the Chaco. According to an analysis made by the Argentine Department of Agriculture the castor bean grown near Resistencia, Chaco, yielded 52 per cent. of oil.

COMMERCIAL OIL PRODUCTION.

There are five important factories in Argentina producing castor oil and several other vegetable-oil factories that manufacture it on occasion. In these factories the oil is extracted both by the cold and the hot process. The product is used both medicinally and industrially. Prices for the 1920-21 crop of castor beans ranged from 14 to 18 pesos per kilo, husked (the peso at that time approximated $0.36 United States currency; the kilo equals 2.2 pounds). The production of castor oil in Argentina is estimated to be between 1,000,000 and 1,250,000 liters (one liter equals 1.05 quarts), all of which is consumed locally. The importation of medicinal castor oil was reduced from 401,660 kilos in 1913 to 116,856 kilos in 1919. Up to the present the castor-oil cake has found no application except as fuel since fertilizers are not ordinarily used in Argentina. The cake has been selling at about 12 pesos per metric ton.

There is an extensive territory in Argentina well adapted to the cultivation of the castor-oil plant, and the farmers of the northern part of Argentina are ready to produce more of the seed if there is a larger market. The oil manufacturers also claim to be able to produce a much greater quantity of castor oil if the market warrants it.

A PLEA FOR THE METRIC SYSTEM.*

For years the problem of introducing the metric system into general use in this country has occupied the interest of physicians as well as of other scientists. This system is today employed in all the civilized world except Great Britain and her colonies, Russia and the United States. Even Russia, before the outbreak of the war, calculated all her imports according to the metric system. The present time seems to be distinctly opportune for a renewed agita-

*From the *Journ. Amer. Med. Assoc.*

tion in the United States for adopting the system. Two million American soldiers received some instruction in its use during their sojourn in France; many of our industrial plants became familiar with the metric scale through work on war material designated for shipment abroad, and the wiping out of international borders is today more closely realized than ever before in the world's history. At its last meeting, a committee of the American Chemical Society recommended the general adoption of the metric scale and requested that chemists hereafter order all supplies in metric quantities. A resolution favoring the method was introduced into the House of Delegates of the American Medical Association, at the Boston session. As one hears of the numerous organizations cited as being wholly favorable to discarding the old methods and to replacing them by the metric, one wonders how it is that the change has not long since been made. The medical profession should take the lead and not follow in this reform. If it is to do this, the first step must be education of the young men. Teachers in medical colleges should teach in terms of the metric system and talk in terms of the metric system at the bedside as well as in the lecture room. To stop at this, however, would be slow work. It is necessary that medical journals, too, should feel their responsibility in this matter. If authors who submit manuscripts do not give measurements in metric terms, the periodicals may aid the movement by making the necessary transposition.

SCIENTIFIC AND TECHNICAL ABSTRACTS

X-RAY OPAQUE MEAL.—Two types of preparation are used in the X-ray examination of the stomach and digestive system, the one, "bismuth milk," in which the salt of bismuth is in suspension in a mucilaginous solution, and the other, "the opaque meal," a semi-solid mixture of the bismuth or barium salt with a suitable food. The essential properties of the opaque meal are, that it should be easy to make, have a pleasant taste, and be perfectly innocuous. The authors have used for some years an "emulsion powder" as a base

for bismuth or barium meals. The formula is that of the French Pharmacopœia, as follows:

Sweet almonds	30	gms.
Bitter almonds	2	gms.
White sugar	30	gms.
Powdered gum tragacanth	0.5	gm.
Orange flower water	10.0	gms.
Water	120	gms.

With regard to the particular opaque substance employed, bismuth carbonate neutralizes more or less the gastric juices, whilst barium sulphate tends to hasten the evacuation of the bowels. Bismuth-subnitrate was abandoned as the cause of a number of accidents. It is very important that whatever salt is employed it should be in a high state of purity.—(M. D'Halluin and D. Raquet [*Arch. d'électric. med.*, 1921, 29, 105, through *Pharm. Journ. and Pharm.*, 1922, p. 264].)

A Color Reaction Common to Antiscorbutic Extracts and to Hydroquinone.—The author has succeeded, by modifying Folin's phenol reagent, in evolving a color reaction for vitamin C. His formula is:

Sodium tungstate	100	gms.
Phosphomolybydic acid	20	gms.
Concentrated phosphoric acid	17	c.c.
Water ....to	1000	c.c.

To this is added an equal quantity of normal sulphuric acid. It is not to be boiled. Unlike Folin's reagent, this does not give a reaction with a variety of organic compounds. It gives a slate-gray color turning to blue with the juices of certain fruits and vegetables the antiscorbutic properties of which are well known (*e. g.*, grapes, tomatoes, cabbage, etc.). Barley, turnips, etc., which are useless in scurvy, give no reaction. Cabbage juice which has been subjected to prolonged boiling loses its positive reaction. The juice of a potato extracted in the presence of an acid gives a positive reaction, but if the acid is omitted or is added subsequently no reaction is obtained. The urine of a man whose diet contains a good proportion of antiscorbutic agents gives a positive reaction. Tried with a variety of phenol compounds, negative results were obtained, except in the case of hydroquinone, which gives a sharp blue reaction.—(N. Bezssonoff [*Compt. rend.*, 1921, 173, 466, through *Pharm. Journ. and Pharm.*, 1922, p. 264].)

American Potash Industry.—Potash is one of the essentials of the American chemical industry, entering as it does so largely into the manufacture of fertilizers. Previous to the war the United States imported 200,000 tons annually. When this supply was cut off in 1905 the chemical industry responded and increased the American production from 1000 tons in 1915 to 54,000 tons in 1918, and poured money into the project until by the end of 1920 the investment represented $28,696,000. Today practically all these plants are shut down, and would-be American producers find that they cannot sell a pound of potash on the American market at any price, owing to the German contracts with the fertilizer manufacturers. A close study of the facts, according to *Chemical and Metallurgical Engineering,* "has convinced us that the American potash industry is deserving of the sink or swim chance which the proposed tariff will afford it" This tariff, for which forty-five potash manufacturers are petitioning Congress, calls for a sliding scale duty on potash imports for five years, at the end of which time potash will go on the free list.

"The war has taught us the value of several key industries, and a surprising proportion of these were our basic chemical industries. Potash proved to be one of those essential commodities, the supply of which we suddeny found was lacking from our industrial make-up, Now that, by long and tedious experimenting and costly research, we have developed the makings of a creditable potash industry, are we going to permit it to thrive or to die? The price to be paid for this domestic industry is insignificant in comparision with its value to chemistry in America. It is scarcely necessary to urge the chemical industries to lend their support to the potash tariff. If our entire chemical independence could but be purchased by the adoption of such moderate rates of duty, we would indeed have cause for rejoicing." The policy of disarmament should not be extended to American industry.—(Through *Industrial Digest.*)

A New Source of Santonin.—Arno Viehoever and Ruth G. Capen. As a result of a survey of American plants it is evident that santonin can be obtained from *Artemisia mexicana* and *Artemisia neo-mexicana*, which grow wild in Mexico, New Mexico and neighboring states.

The survey thus far made comprises seventeen species and plant material obtained from thirty different sources. The santonin isolated was identified by the form and refractive indexes of the crystals, the melting point, furfural reaction, and the formation of santonin periodide.

Though no quantitative data are as yet on hand, the manufacture of santonin now quoted at $150 per pound, from domestic sources, appears a distinct possibility.—(Contribution from the Pharmacognosy Laboratory, Bureau of Chemistry, Dept. of Agriculture.)

A New Hydrogen Process.—Much attention has been paid of late years to methods of obtaining hydrogen, principally on account of its use in the treatment of fats and for the inflating of dirigibles. It has also some applications as a reducing agent and as fuel. The use of ferrosilicon in solution of sodium hydroxide is one of more recent methods, which is described in a paper by E. R. Weaver, presented at the forty-first meeting of the American Electrochemical Society in April last. Although more expensive than other processes, it is suitable for military use on account of the small cost of the plant and the simplicity of operation. The reaction is between the silicon and the alkali, and the principal equation is

$$2NaHO + Si + H_2O = Na_2SiO_3 + 2H_2.$$

This represents the change at the beginning of the operation, but secondary reactions occur by the hydrolysis of the sodium silicate. The temperature must be controlled during the process. The facts that none of the materials used is combustible, that they do not give off any gas until mixed and are easily transportable, are especially advantageous in naval operations. The gas produced is of high purity, traces of phosphine and acetylene being the principal impurities, although hydrocarbons and even arsine may occur. The disposal of the exhausted liquor is, however, a serious matter, as it is too alkaline to be thrown into a running stream.

H. L.

Genuine Attar of Roses Threatened With Extinction.—Roses are yielding to tobacco in Bulgaria. The valley districts which lie at the foot of the Balkans produce more attar of roses than any other region in the world. But unless a check can be placed on a mysterious disease which has recently attacked the rose

bushes there, the fragrant oil will become so costly that very few will be able to afford the luxury of the genuine odor. Many of the rose growers of Bulgaria have become alarmed at the inroads of the disease which threatens their property and their livelihood and have taken up the raising of tobacco instead.

The Bulgarian attar of roses is of a very fine quality, and sells for nearly $125 a pound wholesale in the European markets. In diluted form it is sold as perfume in the shops of Paris and London for five times its wholesale price. The fragrance of two thousand pounds of distilled rose petals is in each pound of the genuine attar. Cheaper perfumes are made artificially, but connoisseurs claim that there is a distinction in the scent and that the artificial variety is not so lasting.—(*Science Service.*)

NEWS ITEMS AND PERSONAL NOTES

Philadelphia College of Pharmacy and Science Notes.

Robert C. White, nationally known as an expert adviser in matters pertaining to manufacturing pharmacy, is the most recent addition to the College Faculty. He is Instructor in Manufacturing Pharmacy.

On Friday Evening, April 4th, at the City Club, members of the Commercial Department conferred on publicity for next year's courses for retail druggists. The course which is designed looks to a practical and comprehensive survey of Commercial science as adapted to the exact needs of retail pharmacy. Professor Cook is in charge of this Department.

Professors Cook and Sturmer recently attended the pleasant ceremony of pyro-martyrdom of the mortgage of the New York College of Pharmacy, not the first time that the destructive distillation of cellulose afforded a reason for ceremonials.

The re-election of Dr. Braisted as President of the College is eminently pleasing to the student body which has collectively learned

to love and to respect Dr. Braisted, whose pleasing personality and devotion to the college cause has won him the admiration of all who come in contact with him.

Ivor Griffith, Editor of the American Journal of Pharmacy and Physiological Chemist to the Stetson Hospital, repeated his One Drop of Blood lecture before the Philadelphia Microscopic Society, at the Wagner Institute of Science, evening of April the 11th, and again, on May 15th, at the Commencement Exercises of the same institution.

Professor Heber W. Youngken has been re-elected editor of the section of Pharmaceutical Botany and Pharmacognosy by the Board of Control of Botanical Abstracts. This is an honor that has successively come to Professor Youngken for a number of years.

Dr. Paul S. Pittenger, Physiological Chemist of the Mulford Laboratories and Professor of Physiological Chemistry at the College, delivered a lecture on the physiological testing of drugs, at the New Jersey College of Pharmacy, Newark, N. J. on March 17th.

The various methods for ascertaining the physiological effect of potent drugs were demonstrated, and revealed the inadequacy of chemical standardization to secure uniformity of therapeutic action.

In addition to the regular student body the demonstration was attended by a large number of physicians and pharmacists who seemed to appreciate the practical application of physiological testing in advanced pharmacy.

President Braisted, with all his activities, finds time to carry the story of the college and its ambitious program to fields never thought of before. For instance, he was recently the principal speaker at a reception of the Kiwanis Club, then before the Art Club and later at the Bellevue-Stratford at a dinner tendered by the Medical Societies of Philadelphia in honor of Dr. De Schweinitz.

A few days ago the Fisherman fareth forth and spendeth full many an hour in the sea-village of Longport. Bountifully equipped and with a Q. S. of the "hope that springs eternal" he looked to a

full basket—when lo, he returneth with a basket void of any "ancient and fish-like smells" but with "tales of diverse wonderful escapes of exceeding many and great Fyshes." He is none other than the Dean of the College.

The Annual Dance of the Kappa Psi Fraternity was held at the Belfield Country Club evening of Monday, March 27th. It was an exceedingly successful affair, well attended and put through with the finesse and eclat that generally graces the functions of the College Chapter of this old and honorable fraternity.

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EDITORIAL

AS OTHERS SEE US.

*"O wad some power the giftie gie us
To see oursel's as others see us
It wad frae monie a blunder free us
And foolish notion."*

So sang the bard of bonnie Scotland. And the "giftie" comes to us now through the medium of the Philadelphia *Public Ledger,* holding in front of us the editorial mirror so that we can peer in and see our true reflection.

And this is what we see:

"Alas, Poor Druggist!

"And now a speaker before the sixteenth annual convention of the California Pharmaceutical Association stands on the platform and delivers himself of the following sentiment: 'Every man who lays claim to any class at all has his pet shade of face powder, his particular fragrance of toilet water, his favorite shaving soap and his distinctive preference in nail polish. The up-to-date man seeks to make himself just as attractive to women as they are supposed to strive to make themselves to men. Druggists must recognize the fact that men now constitute a great and rapidly growing percentage of the patrons of the toilet articles, and they must make greater efforts to accommodate that class of patronage.'

"Time was when the life of a druggist might have been considered a happy one. That was in the balmy and beneficent days of a simpler era. In those days a druggist simply had to compound prescriptions and sell some uncomplicated drugs of common household usage. He could afford to sit outside his store half the afternoon on pleasant days and dispense wisdom to his neighbors. But those sweetly idyllic days are o'er.

"The druggist was forced by evolution of business practice to become a merchant of parts. His day of peace ended when he abandoned the colored lights in his window and added fly-paper to his stock of medicines. He has been adding things ever since. It is long since drugs made a druggist. Nowadays it is note-paper, children's puzzles and safety razors. He watches the once tentative soda fountain grow into a busy quick-lunch counter and the erstwhile speculative pile of Robinson's Family Almanack metamorphosize itself into a magazine and book stand, with a case of fountain pens as an appendix; and as he watches he must regret the days he spent getting his degree of doctor of pharmacy that might have been spent more profitably in a business college.

"Of course, he has the satisfaction of knowing that he fills a more active and conspicuous place in the scheme of civilization than he ever did before. But his satisfaction must be tinged with regret over his ever-increasing responsibilities. And now there is this latest burden. The gentleman from California informs him that herafter he must help bear the burden of 'every man who lays claim to any class at all.' And there are so many men who lay claim to class, even if it be so little, as to be called any at all. With his other cares the druggist must now assume that of chaperoning their development of class consciousness. He must guide them in the proper adjustments of their reactions to the fragrance of various toilet waters. He must help them to cultivate a nice taste in nail polish. If they go wrong on the shade of their face powder, his the blame!

"Verily, the march of progress lays a heavy hand upon us. And here is a new item, this discovery that the male of human-kind has set out to emulate the peacock by making itself attractive to the female of the species with the aid of toilet water, face powder, nail polish and the more subtly seductive varieties of shaving soap. Alas, poor druggist!"

The vision ends. The reflection vanishes.

But we are not conscious after all that we have looked at ourselves. Comes to us the recollection of a seashore trip, when, at that resort, we looked into a crooked mirror and we saw a crooked man, and, although we knew that the crooked man had on our clothes and a personality that, bereft of its distortions, might have looked our very part—still we knew in our heart that this figure in the mirror did not do us justice at all and was but the fun-provoking contortion of a perverted mirror. It produced an earnest laugh, but we promptly sauntered away from that mirror, forgiving it and aiming to forget it, but clandestinely keeping an eye to windward

searching for an honest mirror so that we might convince ourselves that we were not so foolish looking after all.

Indeed, then, we are indebted to the columns of the *Ledger* for holding before us a fantastic mirror that provides us with an earnest laugh. At the same time we do grant that it portrays part of our anatomical landscape with perfect verity.

But there is a greater charm in the story of another mirror, and we take liberties in recording its picture:

> [1]"The learned looking, long faced apothecary of other days, with his round skull cap of ancient black, and the frayed coat of ill-dyed mohair, is no longer with us. The scantily windowed emporium where his highness the apothecary held court among his herbs and simples and the gaudy pots of cerates and unguents, is but a retrospective vision, and while we can quite comfortably conjure up nice things to say about the venerable old institution and its occupant, none of us in a sense regrets the passing away of them. The evolution which came with the racing years saw the dusty but respectable old apothecary changed into the dapper business-like pharmacist who, at our street corner, cheerfully supplies our every want, in his and many other lines. The dustier emporium where the accumulated odors of old and evil smelling herbs long offended our finer sensibilities has been supplanted by the broad windowed and well ventilated business establishment where the olfactory equipment of the most delicate patron is never offended except when an occasional prescriber persists in exploiting the foul valerianate.
>
> "With this mutation, however, came of necessity a complementary change and a change that is not to the liking of any of us. The apothecary of other years, in spite of his murkiness and dust, cherished in his heart ideals that reflected much credit on his profession. He was often a keen student, a wide reader, and a clever experimenter, and quite conscious of his importance as the physician's co-worker and assistant in the altruistic task of curing the ills of the people.
>
> "The pills that he dispensed in their neat turned wooden containers were his own handiwork. He fashioned them with his own fingers and knew with considerable exactness just what they contained and precisely how much of each ingredient. The plaster which he handed to his patron was likewise a product of his establishment. Evenly spread on a piece of fine chamois or flannel and carefully cut with his own deft hands it pos-

[1] A former contribution by the Editor to another drug journal.

sessed virtues that no factory made plaster, no matter how pleasing to the eye, can ever hope to possess. His unguents and cerates were especially his pride and his repository of these smooth and gritless articles of medical ware held a prominent place in his emporium. The containers, gaudy in blue and gold and neatly arranged in even shouldered rows like a street of mosques or minarets, blazoned forth the story of his eternal care in all things that really pertained to the professional side of his make-up.

"Today, however, the rolling of real pills is almost an Egyptian art, and the novice on the staff of the pharmacy wonders whether the pill machine is an instrument of torture or some forbidden gambling device. The excipient bottle hides behind a bottle of aspirin tablets and the althæa container complains of inertia. The plaster machine, perforator and cutter, rusty and forlorn looking, repose in the cellar with the rest of the questionable junk, those things which we expect to discard tomorrow, the tomorrow that never comes. The lettered ointment pots still remain, but bereft of their former glory and their contents can no longer proclaim the glory of the magister's handiwork, for they are but part of a fifty pound batch from the ointment factory.

"The pills in the modern pharmacy, the thousand odd varieties in their riot of colorful trappings, all come from some pill factory or other where giddy machinery turns them out by the millions, even-shaped and uniform in size. They lack the personality of the old hand made soft mass pill of the apothecary that even before Bertillon's days often exhibited very distinct digital prints. What they lack in personality they may discount in cleanliness. But we still persist in the belief that in therapeutic efficacy the pills of the old apothecary far excel the fossilized, petrified pills dispensed today in many a store and many a doctor's office. Those hand made plasters that we know no more are displaced by the neat gauze covered plasters made by the mile and sold by the yard. And other, many other, things that the old apothecary loved to prepare with his own hands are now made in the factory and doled out in portions to the purchasing druggist.

"Thus the work of the apothecary has gone out of his hands and he is now in the main but a jobber of other people's manufactures. Many persons today say that the pharmacist as such has no real reason for existence as a professional man; that the commercial phase of his makeup has of necessity and quite naturally overwhelmed or eclipsed the professional side of his calling, and the grocer and hardware dealer have as much right as the pharmacist to be deemed professional. There is quite some reason for persons holding this viewpoint. Many drug

stores are ridding themselves of their prescription practice because they find selling talking machines more *profitable*, and since profit is all that the philosopher's stone means for some people—that is a wise thing for them to do. Other drug stores for all the real prescription service that they can furnish might serve the public *better* by selling more talking machines and compounding fewer prescriptions.

"There is no one to blame for these changes. They have come to us simply as a natural course of events. Pharmacy cannot say that her birthright has been craftily taken away from her. Nor can we say that the change has been due to negligence on the part of the individual pharmacist. Indeed, with the rapid and marked changes that have come his way it is surprising that things remain as well as they do.

"We have spoken of yesterday and of today, but what does tomorrow hold for us? If the pessimist among us can dwell on the lost art and the passing away of the profession, can the optimist see in tomorrow a promise of a return of the heritage and a rehabilitation of the calling? Shall we go on as vendors of ready made medicines, and as commercial, public serving institutions on a par with the corner grocery or delicatessen, or are there hopes of more opportunities for the pharmacist to offer real professional service? That is the question.

"And it is a question that is difficult to answer even in an approximately correct fashion. In truth ninety per cent. of our retail pharmacists, in spite of their inherent desire to be considered members of a profession, are *disinterested* and meekly accept a tradesman's mode of making a living. And this is in a sense humanly natural. It is almost inconceivable that they can, under existing conditions, aspire to anything higher than or different from what they are doing. They intimate that the greatest portion of the agitation which constantly demands the attention of the calling is fostered by persons who are in a sense outside the realm of the calling itself. The college professors and State Board members are stated by them to be responsible for the gossiping and mischief making that often bid fair to disturb the harmony of the inner circle of the pharmacy and to eventually cause the divorce of the professional from the commercial side of the calling.

"Asks the corner druggist 'why on earth the need for all this disturbance? There is nothing wrong at all in harmonizing the business phase with the professional end of my life work. I can compound prescriptions quite as accurately and at the same time enhance my picayune professional receipts by collecting commissions on the sale of a Victrola.' And the citizenry has been taught to understand things according to his

light. The lay person will cheerfully listen to a selection of records while waiting to have his prescription filled even though he appreciates that it is a long way from selling a talking machine to compounding a prescription. The same person would steer very clear of a doctor who would listen to his heart sounds and at the same time try to sell him an automobile.

"In other words, the public has been improperly guided to the illusion that the diversified features of the pharmacist's business in no way impair his usefulness as a man who in his spare moments can offer a little professional service in the way of compounding a prescription or two. And without being unduly pessimistic we often feel that it is this apathy exhibited by the public mind that has helped to demoralize pharmacy. It is only when the public is disillusioned and taught again to demand real professional service from the pharmacist that pharmacy will come into its own. And how can the public obtain this new impression of the service that can be offered by the new pharmacist? As we see it—only after the pharmacist is properly equipped to offer this type of professional service—and this equipment consists of a liberal education, and the capacity to serve.

"There never has been a time more fortunate than the present for pharmacy to assert itself and to proclaim its real and tangible claim and ability to render truly professional service. The art of medicine is rapidly attaining the heights of true science and the time is long past when the 'handmaiden' of medicine had nothing else in her code of duties but the compounding and dispensing of medicine. The scope of true pharmaceutical service has considerably broadened and the prescription department will not be the only herald of professionalism in the pharmacy of tomorrow. There are opportunities, even if not boundless, for offering clinical service. The new pharmacist shall and must be so trained that he can offer the physician this high type of service.

"The natural recoil which wise men long ago predicted has come and physicians do not place as much reliance today upon purple pills and tasteless tablets as they did a decade ago. The experience of years has taught them that the old fashioned recipe, freshly concocted and properly prepared, has much in point of advantage over factory made compressed medicines. The world war period also has changed many dispensers into prescribers, who found it more economical to let the pharmacist buy when the prices of drug substances climbed to such dizzy heights and many of these war made prescribers will continue in their more pleasant and less costly habits for some time.

"Botanical drugs are rapidly pushing to the front again, and the old school which taught 'that there is a plant in Nature's garden for every human ill' is re-establishing its grip on the physician's mind.

"With these facts in mind there comes to us mentally a picture of what we choose to term the new pharmacy.

"To the general public this pharmacy will offer such articles as are legitimate drug store products—sickroom equipment, spices, crude drugs, toilet preparations and perfumes, official preparations and household medicines. It will leave the coffee and tea to the grocer, the cigars and cigarettes to the corner cigar store, the soda fountain and candy to the confectioner. To the physician it will offer clinical service, diagnostic tests such as blood counts, biochemic analyses, bacteriologic procedures, vaccine and bacterin preparations, urinalyses, water analyses, sputum and smear examinations, complement fixation tests and all such items of clinical work.

"The pharmacy can well be the place where the physician can obtain information concerning new and rare articles of materia medica as well as a supply of the articles themselves. The library of the pharmacy shall be comprehensive and at the service of the physician. The well trained pharmacist can readily by these means become the confidant of both the physician and patient and will earn the respect of both. The prescription department will be modern in every respect and supplied with nothing but the highest grade of drugs and medicines. Its personnel shall be intelligent and painstakingly careful, its equipment up to date, and its conduct immaculately clean and correct. There will be no counter prescribing, and the complementary evil—dispensing by the physician—will naturally subside and probably be a negligible factor of competition.

"It may be only the Arcadian pharmacy that will conform to all the foregoing stipulations—but Arcadia was never closer to us than it is now.

"The recrudescence and rehabilitation of the profession of pharmacy will be made certain only if standards and instruments of education are elevated to such a scale as to insure for the conduct of these several professional duties men who are completely fitted by training to their respective parts. The divorce of the commercial from the professional will come then as a matter of course. The writing on the wall has it that the ninety per cent. commercial and ten per cent. professional drug store shall inevitably pass away and its professional duties be absorbed by the new and ethical pharmacy.

"The new pharmacy managed by the new pharmacist is to re-establish itself as a serious, legitimate and altruistic profession, and the sooner it comes the better it will be for everyone concerned, the physician, the laity and the pharmacist."

And the story of this mirror is no illusion.

I. G.

SELECTED EDITORIAL

THE FAITH OF THE SCIENTIST.*

The things we are surest about we do not talk about. We do not have to. There are certain things that all sensible men take for granted and there is no use tying to convince those who are not sensible. But once in a while it is well to dig down to the very foundations of our faith to see what they are.

There is one principle that underlies all of the sciences as it does all ordinary life and yet is not often specifically pointed out.

This is the invariance of nature or the constancy of cause and effect. That under the same circumstances the same thing will happen always anywhere. This is a bit vague, for, of course, the circumstances are never twice the same all through the universe. And nobody can prove it or tell why it must be so.

For instance, who knows if the law of gravitation will hold true tomorrow? Why should not all particles of matter repel one another instead of attracting one another?

Suppose some erratic oak tree, in a desire to be original, should begin to bear watermelons instead of acorns? Who is entitled to tell it that it cannot? Suppose the earth should get tired of always turning the same way and take a notion to turn from east to west for a change? How do you know it won't? You don't know. Yet you are sure it won't.

The only reason you can give is that this never has happened, but that is merely the prejudice of the conservative, the negation of all progress.

*Through *Science Service.*

Yet this principle, that like causes always produce like effects, has to be assumed by pure faith before we can undertake our next day's work. It is also a necessary assumption in all scientific calculations. Let us consider, for instance, the astronomer, for he indulges in longer term prophecies with greater assurance and success than any other scientist. The point is best put by a French poet, Sully-Prudhomme, in a beautiful sonnet that may be translated as follows:

THE RENDEZVOUS

By Sully-Prudhomme

'Tis late; the astronomer his vigil stern
On lofty tower prolongs. In silent space
He seeks his golden isles, nor turns his face
Till starry host grows pale with morn's return.

Bright worlds, as grain the winnowing flail doth spurn,
Fly past thick-clustering nebulæ a-light;
His eager gaze one streaming orb pursues in flight,
He calls: "This hour, ten centuries hence, return."

Return it shall. Nor time nor space abates,
The Everlasting Fact it never can assail.
Men pass from view; Eternal Science waits.

And though Humanity itself should fail,
Fair Truth will stand, alone, upon the tower
To keep that tryst at the appointed hour.

(*Translated by F. P. H.*)

Now I fancy that Sully-Prudhomme, with poetic license, has exaggerated a bit the marvellous power of prescience possessed by the astronomer. To fix the exact hour for a comet's return a thousand years in advance is rather closer figuring than we can do with certainty. There is always the possibility that the comet may be wrecked in a collision or side-tracked by some star.

But Sully-Prudhomme does not exaggerate the confidence of the scientist in his fundamental principle of the constancy of natural law. The astronomer is willing to stake his life, or what he values more, his scientific reputation, that if none of these accidents happen and if he has rightly weighed all the factors involved the result will be exactly as he says. He is so sure of it that if a comet does not return on an expected date he will be confident that some unfore-

seen force has intervened and he will set about to find it. If he does not find out what is wrong, other astronomers will take up the task and devote their lives to finding the cause of the discrepancy. They may keep at the problem for a thousand years and never think of saying: "Well, perhaps there isn't any reason. Comets are queer things anyway."

And if an oak tree should take to bearing watermelons—things almost as unexpected have happened—the botanists would be absolutely positive there was something new inside or outside the tree that set it to acting so. They would start to experimenting and probably find out what it was in the course of time. "There's a reason" is the faith of the scientist and so far he has never been belied.

EDWIN E. SLOSSON.

ORIGINAL PAPERS

THE PROFESSION OF PHARMACY.*

By VICTOR C. VAUGHAN, M. D., LL. D.

Mr. President, Members of the Faculty, Students of the Graduating Class:

It is a great honor to be called upon to deliver the commencement address at this ancient and honorable institution of learning. I have chosen to speak to you concerning the profession of pharmacy. From the remotest times of which we have record those who prepare medicines have been set aside as a special, learned and honorable class. In the papyrus of Sent, written 3000 B. C., it is shown that the physicians of that time sent their prescriptions to the priests of Isis, who prepared them, and accompanied their preparation by certain ceremonies and incantations. In the Ebers papyrus, 1550 B. C., special mention is made of pharmaceutical preparations, including not only vegetable drugs, but also mineral preparations, ointments, blisters, etc. In the Old Testament the apothecary and his art are frequently mentioned. Moses, in the thirtieth chapter of Exodus, is instructed by the Lord to take pure myrrh, sweet cinnamon and

*Commencement Address before the Philadelphia College of Pharmacy, June, 1922.

calamus, and make thereof a holy ointment compounded after the art of the apothecary. With this he was told to annoint Aaron and his sons and consecrate them that they may minster unto the Lord. In Ecclesiastes we are informed that the pharmacy of that time included a large number of vegetable preparations—myrrh, calamus, cassia, cinnamon, galbanum, and others being mentioned. The gathering of mandrakes and their value are mentioned and emphasized in the thirtieth chapter of Genesis.

The Chinese practiced pharmacy many centuries before our era, and when their records have been studied accurately I have no doubt that much light will be thrown upon the early superstition of man. Within our own time we have seen native Chinese prescriptions made up of varied collections of plants mixed with the bones and excrement of animals. We look upon these remedies and think of man's taking them with disgust, but we should remember that for centuries it was a common belief, apparently of world-wide distribution, that the excrements of animals retained the properties of the animal from which they came. The English pharmacopeia as late as 1721 provided for remedies prepared from oyster shells, crabs' eyes, burnt harts' horns, crabs' claws, and other equally inert and uninviting preparations. A powder sold in England as late as the middle of the nineteenth century consisted of crabs' eyes, crabs' claws, certain excrementitious substances, and a jelly obtained by boiling the horns of a stag. This powder had quite a vogue, was prescribed by some learned physicians, and was purchased by the superstitious wealthy at a price of 40s. per ounce. Indeed, it is not necessary to go back far in years or to leave our own country in order to show that animal excrement has been used in the treatment of disease. I, myself, have seen a tea prepared from the dung of sheep administered to children suffering from measles, and I have known of the application of the skin of a black cat, killed in the dark of the moon, to the head as a cure for epilepsy.

Polypharmacy, by which is understood the mixture of a great many substances in a single prescription, came into vogue many centuries ago and has not entirely disappeared up to the present time, although it is condemned by both pharmacist and physician. Some of the older shotgun prescriptions contained from fifty to seventy ingredients, and I have found a patient taking, on the pre-

scription of a physician, not only chemical incompatibles, but also physiologic antagonists.

One of the most ancient, and probably the most important, works on materia medica of the time was written in the first century of our era by Dioscorides. This work enumerated four hundred plants and drugs, and it continued to be the chief reference work on this subject until the seventeenth century.

Laws for the purpose of securing the proper perparation of prescriptions and for the prevention of the introduction of poisonous ingredients extend far back in time. In the eighth century the Arabs, who at that time were the leaders in medicine, legalized the apothecary and prescribed his duties. In the thirteenth century Frederick II enacted a law, which for a long time remained in force in Sicily, and which forbade the employment in any prescription of impure, adulterated, or noxious ingredients. According to this law, pharmacists were divided into two classes, one of which limited its trade to the sale of simple drugs at prices fixed by the law, while the other prepared and dispensed prescriptions written by medical men. During the middle ages pharmacy seems to have been largely under the control of the Benedictine Monks, some of whom, like Basil Valentine, made important contributions to both pharmacy and chemistry.

A prominent London apothecary, a cousin of Anne Boleyn, one of the unfortunate wives of Henry VIII, wrote as follows concerning the pharmacist: "His garden must be at hand, with plenty of herbs, and seeds, and roots. He must read Dioscorides. He must have mortars, pots, filters, glasses and boxes clean and sweet. He must have two places in the shop, one most clean for physic, and a base place for chirurgic stuff. He is neither to increase nor to diminish the physician's prescription; he is neither to buy nor to sell rotten drugs. He is only to meddle in his own vocation; and to remember that his office is only to be the physician's cook." The apothecaries, or pharmacists, of England were first incorporated with the grocers, but this proved unsatisfactory and a separate charter was obtained in 1617. There were at that time, it appears, one hundred and fourteen pharmacists in London. The law provided that the sale of medicines should be wholly in the hands of the apothecaries, the surgeons on the one hand and the grocers on the other, being forbidden to sell medicines. In 1841 the Pharmaceutical Society of Great Britain, "for advancing the knowledge of chemistry and pharmacy and

promoting a uniform system of education for those who should practice the same, also for protecting the collective and individual interests and privileges of all its members, in the event of any hostile attack in Parliament or elsewhere," was instituted and two years later a royal charter was granted. This society now controls and directs the practice of pharmacy in Great Britain. In that country one who wishes to enter the profession must pass a preliminary examination before he can become a registered student or apprentice. A second examination is necessary before he can become a registered chemist or druggist. A third, or major, examination qualifies for registration as a pharmaceutical chemist. In most countries of Continental Europe, the preparation and dispensing of prescriptions is limited to pharmacists. The pharmacist is not allowed to prescribe, nor is the medical man permitted to dispense except under special license and in rural and village communities where a pharmacist could not make a living. In Holland it is illegal for a pharmacist and physician to make any agreement as to the supply or price of medicine. In Austria, Germany, Italy, and Russia, the number of apothecaries is limited by law according to the population. In France, Switzerland, Belgium and Holland there is no such limitation, but in practically all Continental European countries the pharmacist confines himself to the filling of prescriptions, of which he must keep copies for a definite time.

The history of pharmacy in this country is, I suppose, quite familiar to all of you. This college, I believe, was the first devoted to pharmacy to be established in the United States, and it is not a discourtesy to other colleges of pharmacy to say that this institution has been the leader in professional education throughout the one hundred years of its existence. During the third quarter of the last century, schools of pharmacy were established in several state universities. At that time the pharmacy school consisted largely of the chemical laboratory and one of the professors in the pharmacy school was, in several instances, at least, director of the chemical laboratory. About the same time the manufacturing chemist came into existence and developed like a green bay tree. The compounding of prescriptions by the pharmacist has become an almost lost art; in fact, the local pharmacy has almost passed out of existence. The drug store has been converted into soft drink parlors, cigar shops, and miscellaneous sales rooms. In the drug stores medicines prepared by the

manufacturing chemist are sold, but the salesman need not know anything about pharmacy. To the superficial observer the pharmacist has lost much in dignity and importance. Fifty years or more ago the apothecary's apprentice was instructed in the delicate and difficult art of compounding prescriptions. He took his first lessons in practical chemistry. He was compelled by the demands made upon him daily to familiarize himself with the directions contained in the pharmacopeia. Hourly he consulted that voluminous and weighty volume known as the dispensatory. In order to answer intelligently the many questions asked him, he spent largely of his spare hours poring over his materia medica, and in order to keep abreast of the times and be able to converse with the young doctor whose pills and powders he compounded, he had to read current medical and pharmaceutical journals. Indeed, the old pharmacy laid the foundation for many a chemist, pointed out the pathway to many a naturalist, and opened the way for many young men who entered upon the study of medicine. The apothecary's clerk of that time, while he did much menial work, such as cleaning mortars and pestles, was compelled to develop his brain at the same time. As a school of experience and an opportunity for intellectual growth, the drug store of today, with its fancy show windows, its marble soda water fountain, and its ice cream restaurant attachment, does not compare with the sombre old apothecary shop of one hundred years ago. Does this mean that there is no longer need of intellectuality in the life of the pharmacist? I think not. The pharmacist may be defined as one who is concerned in the preparation of any medicinal agent, whether such agent be mineral, vegetable, synthetic, or biologic; in fact, the field of pharmacy has been within the past fifty years so greatly enlarged, so markedly increased in fertility, so greatly multiplied in the variety of its products and so diversified in the methods required for its proper cultivation, that the old-time pharmacist has for the time been almost forgotten; but we cannot afford to neglect him or to dispense with his services.

In fact, the duties of the pharmacist have been multiplied a hundredfold. The manufacturing chemist of today in part takes the place of the old-time pharmacist. Instead of making pills in a mortar and on a tile by the dozen he now makes them in hundreds, runs the paste through a machine, and turns out the product by the hogshead. He coats, glosses or capsules his nauseous drugs, render-

ing their deglutition more acceptable, while in no way impairing the promptness and efficiency of their action. There is still a promising field for research in the purification and modification of the active principles of certain plants and their products. That this is true is shown by the recent advances made in the treatment of leprosy with the purified substances obtained from chalmoogra oil. The relation between chemical structure and physiologic action suggested many years ago by my friend, Sir Lauder Brunton, has not yet been satisfactorily worked out, but the diggings have unearthed valuable nuggets and the possibility of reaching or tapping a paying vein is still open to us. During this dispersion period of the activities of the pharmacist, the science of pharmacology has come into existence, and, so far, its development has been gratifying. It is now one of the functions, and a most important one, of the pharmacist to test the physiologic action of medicinal agents on the lower animals. It would be most interesting, had I time, to trace the development of studies on the physiologic effects of drugs and other agents. It is said that this work was begun by Wepfer and Brunner about the middle of the seventeenth century, when they demonstrated and studied the tetanizing action of nux vomica on dogs. Early in the eighteenth century the great physiologist, Albert von Haller, experimented upon man and animals. In 1765 Fontana reported 6000 experiments with the venom of snakes on animals. In the early part of the nineteenth century pharmacology, or the study of the action of drugs, their active principles and chemical compounds, upon the lower animals was greatly advanced by French physiologists, notably Magendie, Claude Bernard and others. About 1850 Buchheim founded in the University of Dorpat, the first pharmacologic laboratory, in which he and his successor, Kobert, did splendid work. In 1873 there appeared the first special journal on pharmacology, the *Archiv. für Experimentelle Pathologie und Pharmakologie*, or, as it is generally known, *Schmiedeberg's Archiv.* There are now at least three journals of world-wide repute devoted to this subject. Basil Valentine, when he wished to study the effects of antimony on animals, at least so the report goes, first tried his preparation on hogs and finding that these animals thrived on his discovery, fed some of his fellow-monks with the preparation; and finding that they promptly died, he designated his discovery as antimonk or antimony. Having advanced somewhat in our morals since the time of the learned monk just re-

ferred to, we now test out our medicinal agents on rats, guinea pigs, dogs and cats, although there are those among us who seem to think that we should return to the old method of first testing out our discoveries on human beings or give up all effort to make discoveries in our combat with disease and in our effort to protect our fellow man from unnecessary suffering and untimely death.

The purpose of such a school as yours, whose commencement exercises we are now celebrating, is not, as I conceive it, to supply the drug store of today with salesmen. In my opinion, this school has a higher function than that of furnishing clerks who wait upon customers at soda water fountains, sell cigars, and incidentally fill the prescriptions of physicians for preparations manufactured by large drug houses. There is need of skilled chemists in every one of the many branches into which this science is now divided. All the mysteries of inorganic chemistry are not yet solved and in these lie great possibilities, the realizaton of which may materially modify the progress of civilization. The unknown in plant chemistry offers a boundless field for research. There are chemical substances essential to plant growth, the formulæ of which are as yet unknown. A few years ago the food chemist thought that he had quite exhausted his problem. He had determined the amount and kind of inorganic salts, carbohydrates, fats and proteins—necessary food constituents of the daily ration of the man who would do a day's work, but when he tried to sustain health by the administration of his purified food principles he found that something was lacking. Then he read history a little more closely and acquainted himself with the wonderful stories of scurvy and beriberi and how epidemics of these diseases had been arrested simply by the administration of certain foods. In short, he found that something besides his five food principles was necessary in order to keep the animal body in health and enable it to do its work. These unknown but essential constituents of our daily food are now designated as vitamins, a term which inadequately covers our ignorance. Indeed, some are inclined to say that the vitamins have no actual existence and that their functions result from certain unknown relationships between constituents of food which are probably well known. This seems visionary and a search through chemical and physicial agencies for the vitamins should be tempting to both the skill and intelligence of the brighest young men.

It has long been known that both therapeutic and poisonous sub-

stances when introduced into the animal body have a selective action. Each seeks its own predilection tissue in the body, and acts more or less specifically thereon. Strychnia and allied bodies manifest their activity, most seriously at least, on the cord, and modify those bodily functions which are controlled by the nerves originating in the spinal cord. Other drugs act more specifically on the liver, some on the alimentary canal, others on the organs of elimination, while still others have a more direct action upon certain constituents of the blood. In searching for new therapeutic agents, Ehrlich has pointed out the way in the discovery of 606 and the demonstration that this product has a specific action upon the spirochetes of syphilis: in fact, empirically the medical profession has known for some centuries that quinine has a specific action on the malarial poison, and that the active principle of ipecac has a similar effect upon the organisms which cause certain forms of dysentery. It is within the range of possibility that the time will come that a preparation will be built up synthetically for the purpose of having some direct action upon a given tissue or upon some parasite, the destruction of which is desired; indeed, the possibilities which lie before the well-trained chemist and physicist are unlimited in number and unbounded in scope, while the effect of their application upon the welfare of mankind must await future determination.

The learned man, Admiral Braisted, who is now your president and director, has wide vision for the future of the Philadelphia School of Pharmacy and Science; indeed, I do not hesitate to say that he is a dreamer, and I use this term in no derogatory sense. Every great project, whether it be educational, political, economical, or scientific, is the product of mind activity. All these things must be visions or dreams before they are cast into realities, and when I say that your worthy president is a dreamer, my intention is to confer upon him a high compliment. He who has never built a castle in the air never builds a cottage on the earth. Without dreams there would be no reality. Dreams, such as I speak of, are the light waves which point out possible paths through the forests of the future, some of which surely lead to fertile lands. Your president desires to see this college expand greatly in facilities and in accomplishments, and I see no reason why his dream does not rest upon a substantial basis. There is here ample opportunity for the man of wealth to give of his excess in order that the condition of life among his fellow-men

might be improved. I am sure that there has never been a time when the intelligent public, both individually and collectively, has been so appreciative of scientific research as at present. The world-wrecking war through which we have passed, was a combat between German and Allied sciences, in which the latter finally overthrew the former. The war was a demonstration on a world-wide scale of the necessity for the national protection and help of science. With therapeutic agents, with disinfectants of great effectiveness, with vaccines and serums of specific action, produced for the most part by pharmaceutical processes and as a result of pharmacologic investigations, the medical corps of the several armies maintained a degree of health in the field hitherto unknown in the annals of war, protected the soldier against possible infection, and restored a large percentage of the injured to the fighting line. All of these things were demonstrated on the greatest stage the world has ever known. The various medical cults, the so-called Christian healer—those who would make us believe that they are able to work miracles in the prevention or cure of disease, were not found with the soldiers in camp, on the sea, or on the firing line. Scientific medicine, armed with the products of the highest pharmaceutical skill, demonstrated its value, and, as a consequence, wealthy individuals are today giving money in large sums to medical schools, to medical research institutions, to medical investigations, including those that are concerned in the production of more efficient therapeutic agents. I am sure that at no time in the history of the world has science, especially applied science, been the recipient of larger donations from private wealth than at present. It is only necessary for a physician or a group of physicians of good repute to appeal for private aid in order to foster some beneficent research, to secure all that is asked. This is true not only of private wealth, but it is also true of public aid along the same lines. Apparently, Congress is willing to vote millions on a fifty-fifty proposition to aid states in taking care of the physical and health needs of the people. Just now there seems to be no limit to the sums demanded for the ex-soldier, both the physically disabled and those in sound health. Several States have already provided for liberal bonuses to all, and our Congress is apparently just now on the eve of pouring out more millions. State legislatures are supporting the scientific departments of their universities, including both medicine and pharmacy where these exist, with a liberality hitherto unknown.

In a spirit of great generosity the state is providing for the physical needs of the unfortunate of every class. State boards of health are receiving liberal appropriations and are being given wider authority. Vaccines, antitoxins and antisyphilitic preparations are being distributed with the greatest liberality. The amount of money that has been spent since 1917 by the National Government, by some States, and by certain municipalities in dealing with the venereal diseases can be designated as liberal, and in some instances it would hardly be an exaggeration to say that it has been extravagant. Cities and rural communities are building and equipping hospitals and demanding that all citizens shall enjoy the benefits of the most advanced scientific medicine, whether it be preventive or curative. Scientific research, especially that which pertains to pharmacy and medicine, until a few years ago a mendicant begging a few pennies at the doors of private wealth and in legislative halls, is now the frequent recipient of great gifts from both private and public sources. I am sure that there are in this country holders of large wealth which has been gained by scientific discovery of therapeutic agents, and I advise that the president of this college apply to these men and to other men of wealth, specifying the possibilities that lie within the reach of this institution and calling upon them for abundant endowment. I believe that such an appeal will not be in vain, and with adequate facilities for research no one can foretell how rapidly or in just what direction progress will be made, but, that it will come, and having arrived will be a benefit to all, there can be no doubt.

I cannot permit this opportunity to pass without giving a few words of special advice to the members of the graduating class. I presume that during your college course you have become familiar with the basic facts of the fundamental sciences—physics, chemistry, botany and biology. Upon these all science rests. Continue your broad reading; keep up your interest in the fundamentals, but at the same time select one line of study, learn all that is to be learned about this subject, which, by the way, must not be too broad, and then go on in your investigations and know more about it than any one else knows; in other words, be not only a consumer, but be also a producer. The world needs scientific men with broad fundamental training, and in addition to this, the world needs the expert,—the discoverer, the explorer, the man who opens up new continents. I could have no greater satisfaction than to be assured that at least one of your number may make a real contribution to scientific knowledge.

THE EVOLUTION OF CHEMICAL TERMINOLOGY. III. THE "MICELLA."

By JAMES F. COUCH.

The riddle of life has challenged the intellectual efforts of man from the earliest periods of which we have any records. The terrible dread of eternal death has impelled him anxiously to seek for information and to question every phenomenon which might conceal an answer to the enigma. The development of Mysticism and Animism in primitive communities demonstrates the exaggerated authority which primeval man was willing to confer upon any fakir who claimed superhuman insight into this as well as into other mysteries. The savage cowers in superstitious awe before any man or object that may seem intimately connected with events beyond mere human understanding. In all history, even to the present, this element in human nature has played a most important rôle. It appears that the earliest forms of religious ceremonial were merely methods for the appeasing of the wrath or congenital hostility of the powers of darkness who ruled over life and death and who were normally malevolent towards the human race. In all of the primitive religions the gods to be feared are most prominently placed; the benignant spirits are either wholly missing or are subordinate.

A partial and palliative answer to the riddle of life was developed by the Greek philosophers of the Socratic and Platonic school in their theory of the immortality of the soul. Their conclusions, based upon pure reason, have proved satisfactory to the majority of mankind and have been incorporated into practically all of the extant dogmatic systems. Another metaphysical solution of the age-old problem is found in the doctrine of regeneration, which is so prominent in certain of the oriental theologies. Our science has now made us familiar with the fact that certain unicellular organisms are immortal and that death is the price we pay for having evolved and for having developed specialized types of tissue cells, and special organs.

As the dawn of modern time was struggling feebly through the dissolving clouds of the Middle Ages, the microscope was invented. This instrument permitted the curiosity of man to penetrate into the structure of living tissues and the discovery of the cell resulted. Widespread application of this instrument in research determined

the cellular structure of all living things and the doctrine that the cell is the basis of living matter was generally accepted. Further investigation, especially in recent times, has penetrated into the interior of the cell and we now know that this unit is very complex.

Reflection made it clear that the evidence demands the existence of a unit of living matter smaller than the cell but larger than the physicist's molecule. This was first suggested by Henle in 1841, and has been accepted by most cytologists. A number of names for a hypothetical ultramicroscopical vital unit have been proposed,[1] "physiological units" (Spenser), "gemmules" (Darwin), "pangens" (De Vries), "Plasomes" (Weisner), "micellæ" (Nägeli), "plastidules" (Häckel and Elssberg), "inotagmata" (Englemann), "biophores" (Weismann), "bioplasts" (Beale), "somacules" (Foster), "idioblasts" (Hertwig), "idiosomes" (Whitman), "biogens" (Verworn), "microzymas" (Béchamp and Ester) and "gemmæ" (Haacke).

Of the terms listed above, one is of especial interest to students of chemical terminology. The term "micellæ" proposed by Nägeli in 1877 has been employed by the botanists. Today it holds an important place in colloid chemistry as the name for the ultimate colloidal particle. It is destined to even greater importance for it is being used as a base upon which is constructed the newer theories of life and death, of disease, immunity, and anaphylaxis, of development, growth, and inheritance. The "micella" is not only the ultimate particle of colloidal matter; it is the ultimate living thing.

It is the purpose of this paper to point out two sources of confusion and ambiguity which have already attached themselves to this term.[2]

Let us first consider the spelling of the term. The standard English dictionaries are all in agreement in the use of the form "micella" for the singular and "micellæ" for the plural. This usage is followed by the majority of writers and may be considered as established in English literature. The forms "micell—micelles" and "micelle—micelles" are, however, also used especially by those who have become acquainted with the term through French literature. The adjectival form of the term is "micellar," but the form "micellu-

[1] E. B. Wilson, "The Cell in Development and Inheritance." New York, 1900; p. 291.

[2] Earlier papers on Chemical Terminology may be found in this Journal, Vol. 94, pp. 92, 343.

lar" is also found in the literature, though the natural form "micellary" which seems to be the proper form from grammatical rules, does not appear.

This formal confusion in English literature appears to have been the result of an error the responsibility for which cannot be fixed by the writer. The term coined by Nägeli is "Micell"[3] and, being neuter, was rendered "das Micell" with the plural form, "die Micelle." Out of this plural all the confusion has apparently arisen. The plural form is the one most frequently used in the literature, for from the nature of the "micellæ," they are usually spoken of collectively; the single "micella" is seldom referred to. Just as the word molecules is more frequently used than the word molecule. The German plural form "Micelle" is pronounced "micella" to English ears and this fact seems to account for the present English word.

Nägeli coined the term as a diminutive of the Latin "mica"—crumb, particle, bit, and gave the Latin form as "micellum." This is a neuter noun of the second declension whose plural would be "micella." The present English word is a feminine noun of the first declension whose nominative singular is identical with the nominative plural of Nägeli's micellum.

The French use the form "la micelle—les micelles," exhibiting, it must be confessed, much better judgment than we. The adjectival form in use in France is "micellaire," that employed by Nägeli is "micellar."

The English form "micella—micellæ" is, consequently, objectionable and it appears likely that chemists will in the future use the term "micelle" already introduced into chemical literature. To make a characteristic English term the writer would suggest the form "micel—micels" with the adjectival form "micellary."

A much more serious difficulty, however, than this question of orthography arises in the various meanings which are given to the term. These are all closely allied to the original idea of Nägeli, but differ in important details and constitute a source of confusion.

Nägeli conceived the micel as a crystalline molecule-group which may be more or less hydrated. He says[4] "The internal structure of the micel is crystalline, while the external aspect may exhibit all

[3] Theorie der Gärung. München, 1879; p. 121.

[4] *Op. cit.*, p. 123.

feasible forms." In the "Mechanico-Physiological Theory of Evolution" he says further: "Certain organic compounds, among them albumen, are neither soluble, despite their great affinity for water nor are they fusible, and hence are produced in the micellar form. These compounds are formed in water, where the molecules that arise immediately adjoining each other arrange themselves into incipient crystals, or micellæ. Only such of the molecules as are formed subsequently and come into contact with a micella contribute to its increase in size, while the others, on account of their insolubility, produce new micellæ." [5]

Zgismondy interprets Nägeli thus:[6] "Nägeli pictures distensible bodies as small, anisotropic, crystal-like molecular complexes or tiny crystals, that cause the double refraction because of their orienta-

Ellwood B. Spear. New York, 1917; p. 68.

tion. According to this theory the distension is occasioned by the penetration of water into the micellular walls in such a manner that the micells are surrounded by a layer of water." In the same work, page 77, another notion of the micel is stated: "Duclaux . . . has proposed the name 'Micells' for the ultramicrons together with their adsorbed molecules and dissociation products; while the surrounding medium he calls the intermicellular liquid."

This idea of Duclaux is similar to that of Malfitano.[7] "As for me, I have been guided in all these researches by the idea that colloids are double compounds formed of insoluble molecules associated with 1 mol of electrolyte and forming complex ions according to the scheme $(MnA)\pm\ B\pm$."

Duclaux says,[8] "Experience has shown that the particles of a colloid, or micels, are formed of a small mass of insoluble agglomerated matter, electrically charged by one or more ions (the aggregate of nucleus and of these ions forming the granule) and covered on the outside by a layer or envelope, continuous or discontinuous, of ions with a contrary sign."

"In ferric hydrate prepared by hydrolysis of the chloride, the granule is formed of molecules of Fe_2O_3 charged by Fe ions and the external ions are the chloride ions."

[5] The quotation is from V. A. Clark's Summary. Chicago, 1898; p. 2.

[6] "Chemistry of Colloids." By Richard Zgismondy. Translated by

[7] *Compt. Rend.*, 148, 1045-47 (1909).

[8] *J. de Chim. Phys.* 7, 405 (1909).

"In the hydrate of Thorium, prepared by parting the nitrate, the granule is formed of molecules of ThO_2 charged by ions of Th and the external ions are the nitrate ions."

J. W. McBain after many years' study of the physical chemistry of concentrated soap solutions has developed a theory in which he incorporates a definite conception of the micel which differs, however, in some very essential details from the conception of the German and French investigators.[9] The following quotations taken in order from the very interesting paper of 1920 will exhibit McBain's idea of the micel.

"Colloidal electrolytes are salts in which an ion has been replaced by a heavily hydrated polyvalent micelle that carries an equivalent sum-total of electrical charges and conducts electricity just as well or even better than the ion it replaces."

"In the cases of proteins and soaps at high concentration, the undissociated substance is an ordinary colloid while the organic ion is a micelle."

"This refers to the undissociated colloid as well as to the colloidal ion or ionic micelle."

"The conception of these highly mobile heavily hydrated micelle(s), outlined above, was originated by McBain in a general discussion on colloids and viscosity held by the Faraday Society in 1913. It was put forward to remove one of the chief difficulties in interpreting the properties of acid and alkali albumens, since it reconciled their enormous viscosity with their quite good conductivity."

"What is essentially new in the conception of a mobile micelle here presented is the mechanism by which the micelle is built up around an aggregate of simple stearate ions which still retain their original electrical charges."

"Various views may well be taken with regard to the formation of the ionic micelle. For instance, the simplest is to consider it as an agglomeration of palmitate ions, heavily weighted by water, a complex solvate:

$$P_m^{n(-)}.\ m\ H_2O$$

"The water sphere, collected around these enormous electrical charges, is as inevitable as the collection of a droplet of water round

[9] *Trans Faraday Soc.* 1913, Vol. 9, 99; McBain and Salmon, *J. Am. Chem. Soc.* 42, 426-60 (1920).

an electron in saturated water vapor. Probably some at least of the undissociated colloid would also join in (see below).

"The self-same micelle can also be formulated thus:

$$(HP)_n.\ (OH)_m^{n(-)}.\ (H_2O)_{m\ n}.$$

Here the assumption is complete hydrolysis of the palmitate ion followed by complete adsorption of the hydroxyl ions by the fatty acid."

In 1913 McBain spoke of "highly charged colloidal aggregates, micelles, or 'colloidal ions,'" and of "excessive hydration of these micelles (possibly as a consequence of their electrical charges)."

To sum up, McBain regards the micel as a colloidal ion formed of an aggregation of simpler ions and complicated by adsorbed hydroxyl ions and by excessive hydration. The micel is not a unit of colloidal matter, but appears only when the colloid is dissociated and is ionic. It is also not conceived as living matter and this is quite at variance with the ideas of the biologists who use the term.

It is in this latter sense that the term will probably come into common use for the conception of the micel as the ultimate particle of living matter is the view held by the French bacteriologists who are now publishing their revolutionary theories upon the origin, evolution and nature of disease as well as upon the normal physiological processes.

Their ideas are very definite: Danysz [10] states, "The chemical and physiological unit of the plasma is the 'micelle' which possesses for each animal or vegetable species a particular and constant chemical and osmotic equilibrium."

Lumiére develops the idea more in detail:[11] "All colloid material is formed of micels, animated by the Brownian movement, which remain in suspension in the intermicellary liquid. These micels are themselves constructed of a granule or nucelus, that is to say, by a certain number of molecules of a body which is insoluble in the intermicellary medium, and covered with a layer of another and a soluble substance, but which occurs fixed by adsorption, this last being the active portion of the micel."

Speaking of colloidal cupric ferrocyanide he says: "The micel presents a complex organization; it consists of a principal mass

[10] "The Evolution of Disease." Trans. by F. M. Rackemann. Philadelphia and New York, 1912; p. 133.

[11] *Rôle des Colloïdes chez les Êtres Vivantes.* Paris, 1921; pp. 147, 4, 5.

composed of a variable number of molecules of insoluble cupric ferrocyanide, forming a granule, a kind of nucleus possessing a definite electric charge and enveloped by a layer of potassium ferrocyanide, of which the electric charge is of opposite sign."

"From the point of view of weight the granule is by far the most important part of the micel; but it constitutes only a heap of insoluble and inert molecules, of which the tendency to chemical reactions is reduced, while the elements which surround it although they form but a minimal fraction of the micellary arrangement are the active portion of it which principally takes part in the transformations of the colloid."

It is apparent that the view of the micel expressed by Lumiére is of much more universal application than the idea developed by McBain. The latter, in restricting the term to ionized units, has left the true micel, the ultimate particle of colloidal matter, without a name. The former view, however, incorporates the ideas, with modifications, of Nägeli and of the biologists who have used the term during the past forty-odd years. It applies it to every colloidal system and will, without doubt, be extensively used by physiologists and pathologists. Consequently there is certain to arise undesirable conflict between the meanings applied to the same term by biochemists and physical chemists. It is very desirable to avoid this confusion and to define the term exactly. The priority of the use of the term in the sense that Lumiére employs it is indisputable; this fact and the wide applicability of that conception appears to warrant us in refusing to limit the word micel to ionic aggregates only. Therefore it is suggested that the term micel be defined:

> A hypothetical unit of colloidal matter postulated as formed of a nucleus of several molecules of an insoluble compound, and coated with a layer of adsorbed ionized or non-ionized material, the whole combined with a large number of molecules of the continuous phase in which the micel occurs.

SUMMARY.

The history of the term "micella" is related. The various conceptions of the nature of this unit are considered and the conflicting views already published are stated. It is shown that the modern English form of the term is erroneous; that it not only does not truly

represent Nägeli's original terminology, but that it also violates classical good taste. The probability of confusion arising in chemical literature through the use of the term in essentially different senses is pointed out. An acceptable definition for the term is suggested.

EXAMINATION OF THE FRUIT OF SAMUELA CARNEROSANA TRELEASE.

By O. F. Black and J. W. Kelly.

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Recently there came into the hands of the writers some specimens of the fruit of *Samuela carnerosana*, which had been received by the Department of State from the United States Consul stationed at Saltillo, Mexico, where the plant is abundant. Request was made for information as to the possible medicinal properties of the seeds, and the value of the fruit as a whole as a raw material for the production of alcohol.

Since no reference was found in the literature to the chemical properties of this fruit, the sample in hand was subjected to a preliminary examination, the results of which are summarized in the following notes.

A very complete botanical description of *Samuela carnerosana* together with illustrations of the whole tree, the flowers and the fruit, is given in the Thirteenth Annual Report of the Missouri Botanical Garden for 1902. The tree is closely related to the Yuccas, in respect to general habit, floral plan and fruit and seed characteristics, but is distinguished from all other yuccas by having the perianth distinctly tubular and gamophyllous below, with the stamens becoming free only at its throat. These characteristics which deviate widely from all known baccate yuccas, have caused it to be separated into a new genus. The fruits are described as greenish yellow, though sometimes tinged with red or purple, and the soft, sweet pulp is pale in color. They are eaten by birds and rodents, and domestic animals also are said to like them. As the fruits are quite sweet they are enjoyed by the Indian and Mexican children, who call them dates or figs.

The sample of fruit, as received, was in a partially dried con-

dition and slightly worm-eaten. It was, therefore, impossible to make a total moisture determination. The seeds were readily separated from the pods by splitting the latter lengthwise with a knife. Both seeds and pods were dried at 100-110° C. until the weights became constant. The dried pods were found to weigh 190 grams and the seeds 70 grams, or approximately 70 and 30 per cent., respectively, of the dried fruit.

The seeds, which had the shape of flattened disks, were mostly black in color with a few immature light yellow ones. They were ground in a mill to moderate fineness and a portion tested for alkaloids by digestion in Prolius' solution, followed by the usual procedure, but with negative results. The main portion was then subjected to the action of selective solvents. Ether removed a light yellow oil, together with a small quantity of lecithin. The oil weighed 15 grams, or about 20 per cent. of the dry seeds. It is practically tasteless and odorless and may possess medicinal properties. It gave the following physical constants: Specific gravity, 0.9265 at 22° C.; iodine number, 125.6; acid number, 5.13; saponification value, 192.83; index of refraction, 1.4710°; ester number, 187.7. Choloroform extracted a small quantity (2 grams, or about three per cent of the material) of an impure, wax-like product, light green in color, which melted at 215° with partial decomposition, and showed no properties interesting enough to warrant further investigation. Alcohol dissolved out a white, amorphous solid compound, which was readily soluble in hot alcohol, and practically insoluble in cold, thus being easily obtained in a pure condition. It foamed strongly when shaken with water and gave other tests characteristic of a saponin. Compounds of this type are commonly of a poisonous nature, and some have therapeutic qualities. The compound was not found to be highly toxic, as a small quantity injected into a mouse caused the animal only temporary discomfort. Further investigation of this compound might show that it has some valuable qualities, and the ease with which it can be obtained and purified, together with the considerable quantity (about 10 per cent.) contained in the seeds, would make it a hopeful subject for further study.

The pods were amber in color and dried to a horny consistency. The taste was sweet, but the flavor insipid. Weighed samples showed 4.65 per cent. of ash and 0.109 per cent. of nitrogen. Analysis for carbohydrates gave 4.30 per cent. of starch, 62.2 per cent. of reducing

sugars (calculated as dextrose), and 3.80 per cent. of non-reducing sugars (calculated as sucrose). That the reducing sugars are largely composed of fruit sugar was indicated by the melting point and crystalline form of the osazone and also by the strong laevo rotation of the solution when tested in the polariscope.

From the high percentage of soluble sugar, as given above, it would seem that this fruit might be valuable material for the production of alcohol. Approximately 50 per cent. of the dried, whole fruit was found to consist of fermentable carbohydrates. It follows that a ton of dry fruit would give a theoretical yield of 500 pounds of alcohol, although in practice it would naturally fall short of that amount. Such calculations must be regarded with reserve, however, and there is the probability that during the long period which elapsed between the gathering and the analysis of the sample in question the character of the carbohydrates present may have undergone appreciable changes.

The fruit is very rich in pectinous material, which would make it especially suited to the manufacture of jams and jellies, were it not for the lack of flavor. It might, however, be used for this purpose in connection with other fruits which have more characteristic flavor, but which are lacking in pectin.

ON THE STABILITY OF STROPHANTHUS EXTRACTS.*

CLAYRE A. POMEROY and FREDERICK W. HEYL.

The growing use of aqueous solutions of strophanthin under critical conditions where the failure of action would be serious or even fatal, is perhaps due to the fact that it serves its purpose better than the various digitalis extracts which were formerly more extensively used for this purpose. The composition of these were chemically unknown and variable. This variability is increased because of instability. However difficult it may be to secure the therapeutic action of strophanthus *per os*, either because of the difficult absorption or the destructive hydrolytic cleavage by means of the acidity of the gastric juice,[1] the fact is plain that hypodermatically,

*Contribution from the Laboratories of The Upjohn Company.

[1] Johannessohn, *Arch. exp. Path. Pharm.*, *78*, 83 (1914).

rapid absorption ensues, and the desired therapeutic effects are secured.

In order to help prevent this desirable drug from being thrown into disrepute through lack of pharmaceutical control, an early consideration of the stability of this class of pharmaceuticals is desirable. Some work has been reported by Holste,[2] who found that a solution of k-strophanthin (Boehringer) in ampoules, had lost most of its activity after a year; g-strophanthin was found to be stable.

It is necessary to have a complete understanding of the present condition of Strophanthus chemistry in order not to become confused with the various products. Three drugs are found in commerce. Two are official, *Strophanthus Kombe* and *S. Hispidus*. The third is unofficial, *S. gratus*.

From the *S. Kombé*, a crystalline glucoside has been isolated.[3] This is known as crystalline strophanthin Kombé. It contains water of crystallization and when dried melts at 178-179°. It agrees in composition to the formula $C_{40}H_{56}O_{15}.3H_2O$. This product separates directly (0.4%), when a defecated 70% alcoholic extract of the deoleated drug is concentrated. The drug contains in larger quantity an amorphous strophanthin. This amorphous product has the same toxicity as the crystalline substance. The commercial strophanthin is prepared by precipitation with tannin and is a mixture in which the amorphous glucoside predominates.

From *S. hispidus* no crystalline glucoside has been isolated, but the amorphous product obtained by Heffter and Sachs[4] by salting out defecated alcoholic extracts after distilling off the alcohol amounted to 1.7% of the drug. It is known as strophanthin hispidus. This preparation is exceedingly similar to the amorphous strophanthin K., equals it in toxicity, and yields the same "genin" (strophanthidin) on hydrolysis ($C_{27}H_{38}O_7$).

The sugar residues are apparently alike. In respect to the sugar linking these amorphous preparations differ from the crystalline product.

Concerning *Strophanthin gratus* or Ouabain from the unofficial drug; this is a crystalline rhamnoside having the composition $C_{30}H_{46}O_{12}$. This is said to be present in a number of varieties.[5] It is three times as toxic as the previously mentioned products, and is used as a standard for the one hour frog method.

Our interest centred in the official drug, and from samples of this material various preparations were made and studied with

[2] *Zeit. exp. Path. u. Ther., 19,* 153 (1917); (through Physiological Abstracts).

[3] Brauns and Clossen. *J. Am. Pharm. Assoc., 2,* 605 (1913).

[4] *Biochem. Zeit., 40,* 83 (1912).

[5] *Biochem. Handlexicon, 2,* 685.

respect to stability. One solution of the unofficial glucoside ouabain was also prepared and stored.

The results of this investigation, using the official one-hour frog method may be summarized as follows:

(1) Strophanthus seed varies widely in potency, but tinctures retain their original strength, showing marked stability.

(2) Dilute aqueous galenical solutions prepared for hypodermic or intravenous injection, containing the mixed strophanthins deteriorate slowly.

(3) They should be discarded after about one year, although approximately 70 per cent. of the activity is retained at that time.

(4) Crystalline ouabain stored in dilute saline solution (of hypodermic strength) showed a small rate of deterioration.

EXPERIMENTAL.

Tincture Stability. Strophanthus is a most variable drug. Not only is there a large number of varieties, but the range of toxicity of these varieties is very great. We have stored a number of samples of strophanthus tinctures (10 per cent.) which were made by the U. S. P. process, from samples of the seed submitted. These were then tested at different periods to observe the deterioration, if any. The results prove the stability of the alcoholic extracts regardless of the original activity of the drug.

Tincture No. 1.

Date	*M. S. D.*	*Per cent.*	*Period, Months*
1-12-18	0.0002	30	
8-3-18	0.0003	20	7
9-25-18	0.0002	30	8

Tincture No. 2.

Date	*M. S. D.*	*Per cent.*	*Period, Months*
5-1-17	0.00018	33	
7-20-18	0.000193	31	14
5-19-22	0.000200	30	5 yrs.

Tincture No. 3.

Date	*M. S. D.*	*Per cent.*	*Period, Months*
8-10-17	0.0000530	113	
7-20-18	0.0000536	112	11
8-7-18	0.0000540	111	12
5-19-22	0.000060	100	57 mo.

Tincture No. 4.

Date	*M. S. D.*	*Per cent.*	*Period, Months*
8-18-18	0.000083	72	
10-10-18	0.000080	75	2
5-19-22	0.000075	80	3 yrs. 9 mo.

Aqueous Solutions in Ampoules. For hypodermic administration, a saline solution of the mixed amorphous and crystalline strophanthin Kombé from the official drug may be obtained. This preparation will be desirable, however, only when the process is begun with a drug of high potency, thus reducing to a minimum traces of other extractive matter which will accompany the glucoside fraction. By using a drug of the U. S. P. standard, there would probably be less foreign matter in such an aqueous solution than there would be in the amorphous glucosides prepared by the tannic acid precipitation process.

The possibility of deterioration presents the chief difficulty. In order to investigate the pharmaceutical aspects of deterioration, a study was made of the rate of deterioration of galenical saline strophanthin solutions diluted to such a strength that the minimum lethal dose was 0.0005 cc. per gram of frog.

This work was begun with a high grade strophanthus from which a tincture was prepared by the U. S. P. process (200 g. in 2000 cc.). The assay was as follows:

Dose per gm.	*Result*	*Dose per gm.*	*Result*
0.00006	+	0.00009	+
0.00007	—	0.000095	+
0.00008	—	0.000100	+
0.000085	—		

The frogs required 0.0067 g. ouabain as M. L. D.

Therefore the tincture of Strophanthus had an M. L. D. of 0.000064 cc. (94 per cent.).

The tincture was distilled in a vacuum to recover alcohol and water saturated with chlorbutanol was added to make the volume 6.l. The solution (No. 1) was filtered and analyzed (1-12-18).

Dose per gm.	*Result*
.00015	—
.00020	—
.00025	— —
.00030	+ + +
.00035	+

The frogs required 0.0675 g. ouabain as M. L. D. Therefore, the M. S. D. = 0.00020 cc. per gram frog.

By calculation the final dilution was now made and the solution brought to a standard: M. S. D. = 0.0005 cc. per gram frog. (volume = 15 liters). Enough sodium chloride was added to make the solution isotonic (0.85 per cent.) The product was filtered through porcelain and collected in sterile receivers in the usual manner. Part was ampouled into 1 mil. containers and the remainder put aside on ice. The material in ampoules (No. 3850) was assayed as follows:

Date	*M. S. D. Mils.*	*Toxicity, Per cent.*	*Period in Months*
1-15-18	0.0005	100	
5-25-18	0.00057	88	4
7-20-18	0.00060	83	6
8-17-18	0.00071	70	7
10-22-18	0.00080	62.5	9
2-23-19	0.00080	62.5	13
4-7-19	0.00100	50.0	15
8-4-19	0.00111	45.0	19
11-14-21	0.00143	35.0	46

The second portion which had been put aside in the ice chest was ampouled about four months later than the above described (No. 4005):

Date	*M. S. D. Mils.*	*Toxicity, Per cent.*	*Period in Months*
5-28-18	0.00057	88	4
4-7-19	0.00111	45	15
8-5-19	0.00111	45	19

From these results it is evident that these very dilute solutions of the glucosides deteriorate to about half their original activity in fifteen to eighteen months; and that storage at low temperaure does not necessarily favorably influence the rate of deterioration.

A part of the more concentrated solution (M. S. D. = 0.0002 cc. per gram frog) was studied as to deterioration (No. 1).

Date	*M. S. D. Mils.*	*Toxicity, Per cent.*	*Period in Months*
1-12-18	0.00020	100	
8-3-18	0.00030	66	7
4-6-19	0.00040	50	15
8-4-19	0.00040	50	19

It is, therefore, apparent that an increased concentration suffered loss at the same rate as the more dilute solution.

A further experiment on the influence of temperature on the rate of deterioration was carried out in the same manner as above described (No. 4165).

Date	*M. S. D. Mils.*	*Toxicity, Per cent.*	*Period in Months*
10-15-19	0.000476	105	
4-30-20	0.000555	90	6
11-9-21	0.000833	60	25

Another portion of the same lot was kept in an ice chest. It assayed as follows:

Date	*M. S. D. Mils.*	*Toxicity, Per cent.*	*Period in Months*
10-15-19	0.000476	105	
5-1-20	0.000526	95	6½
11-10-21	0.000714	70	25

Here again the loss on deterioration agrees with the first determination. Observations on the effect of hydrogen-ion concentration on deterioration are found in a paper [6] by Levy and Cullen. Data was obtained on the same subject by the use of the cat method for assay. Stability of heat sterilized solutions for a five months' period is shown provided the pH is 7.0. Deterioration is noted in alkaline, but not in neutral or slightly acid (pH = 5.0) solutions. As this point had not been considered by us the hydrogen-ion concentrations of the above solutions were determined by the colorimetric method of Clark and Lubs, and it was shown that alkalinity was not a factor in our results.

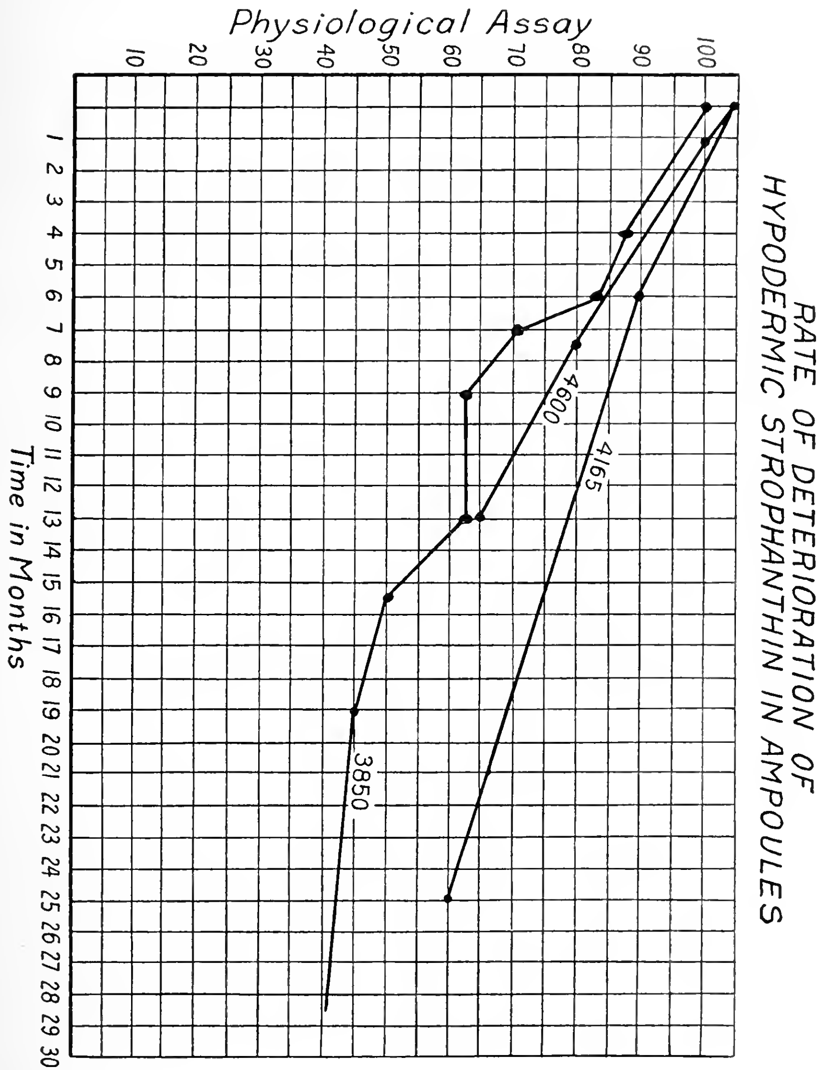
Nos. 3850, 4005, 1,4165 :pH found, 5.8, 6.0, 5.4, 5.6 respectively. The plant extractives yield in this case a slightly acidic solution.

As was previously pointed out,[7] there is considerable discrepancy in results obtained on the rate of deterioration of infusion of Digitalis, depending apparently on whether the cat or frog method is used for the assay. Our results on Strophanthin solutions likewise appear contrary to those of the above-mentioned investigators.

A carefully neutralized (pH = 7.0) Strophanthin solution was

[6] *Jour. Exp. Med.*, *31*, 267 (1920).
[7] *Am. J. Pharm.*, *92*, 394 (1920).

made by the addition of acid potassium phosphate and disodium hydrogen phosphate buffer solutions to a solution made as above described.



The M. S. D. of the solution was 0.0005 cc. per gram frog (No. 4600). It was analyzed as follows:

Date	*M. S. D. Mils.*	*Toxicity, Per cent.*	*Period in Months*
3-29-21	0.000476	105	
4-26-21	0.0005	100	1
11-15-21	0.000625	80	7½ (pH=7)
4-13-22	0.00077	65	13 (pH=7)

For the sake of comparison a solution (1-1000) of crystalline ouabain in physiological salt solution was prepared and diluted to the same standard strength as all the other preparations (M. S. D. = 0.0005 cc. per gm. frog). The solution ws rendered neutral as before with buffer solutions of acid potassium phosphate and disodium hydrogen phosphate.

Date	*M. S. D. Mils.*	*Toxicity, Per cent.*	*Period in Months*
4-30-21	0.0005	100	
11-15-21	0.00055	91	6½ (pH=7)
4-13-22	0.000583	86	12 (pH=7)

It will be observed, that so far as the galenical aqueous strophanthin extracts are concerned, that when the pH is lowered to 7, the solution exhibits a rate of deterioration of about the same order as when pH = 5.4. We would place a time limit on the usefulness of these solutions at about one year. They may be serviceable longer than this, for at this time about 70 per cent. of the activity is retained. The variability in the rate is probably due to variable mixtures of amorphous and crystalline glucosides obtained from different seeds.

In conclusion we wish to acknowledge the pharmacological assistance of Dr. J. M. Schmidt for many of the first assays.

Kalamazoo, Michigan.

ABSTRACTED AND REPRINTED ARTICLES

THE FINENESS AND BULK OF PIGMENTS.

Abstracted by Dr. Henry Leffmann.

The Educational Bureau of the Paint Manufacturers' Association of United States, co-operating with the National Varnish Manufacturers' Association, has established a laboratory for the study of the problems connected with these industries. The procedure is one of many indications of the useful development of systematized research, which has been so much needed in this country. The problems that modern industry faces are numerous and complex and can only be solved by organized methods and by considerable money outlay. The physics and chemistry are both of great importance in this field, and among the special methods the photomicrographic records are of material assistance.

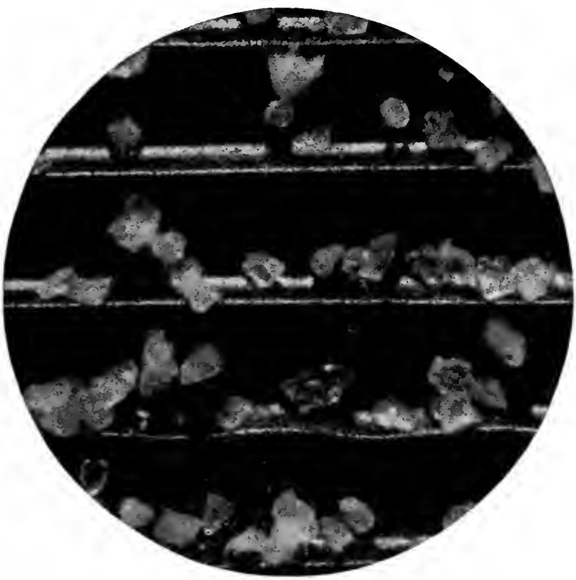
Mr. Henry A. Gardner, in association with Harold Parks and Nils Pihlblad, has devoted much time to the study of fine powders under high magnification, and some of the results have been published in a special pamphlet from which this abstract has been taken. It has been found that the presence in a pigment of an appreciable amount of coarse particles will retard very much the speed of the production of a paint and increase materially the cost of grinding. It is also evident that in the case of remedies, such as calomel and bismuth subnitrate, which are difficultly soluble in water or the fluids of the body, the fineness of the powder will have considerable importance. It may be that the great trituration to which some homœopathic remedies are subjected increase materially their medicinal action. The ordinary works on pharmacognosy do not treat of these powders, but a comprehensive investigation of the commercial forms of them would be of interest and use. The method used for determining the percentage of coarse particles in a given powder is to screen the mass with a screen of 325 mesh upon which 25 grams of the sample are placed. The mass is washed in a stream, while the lumps are broken up by a soft brush. When all materials have

passed through that the mesh will allow, the screen with its residue is dried, weighed and the tare of the screen deducted. It is obvious however, that considerable differences in results with the same powder will be obtained by greater or less energetic use of the brush, so a definite end-point must be adopted. Gardner and his co-workers use a screen 3 inches in diameter made of wire cloth. These are capable of being placed on the pan of an ordinary balance. It is recommended that a number of screens be obtained, and one be set aside as a master screen for checking up the others. The Bureau of Standards has arranged to test screens to determine whether they conform to the United States standard sieve series. Remington, years ago, made a number of tests of screens offered in the market and found considerable irregularity. The thickness of the wire, of course, materially affects the real size of the mesh. The pamphlet gives in detail the methods pursued and discussions of the value of the results. Through the kindness of Mr. Gardner several of the blocks showing the microscopy of the powders have been loaned for use in connection with this article.

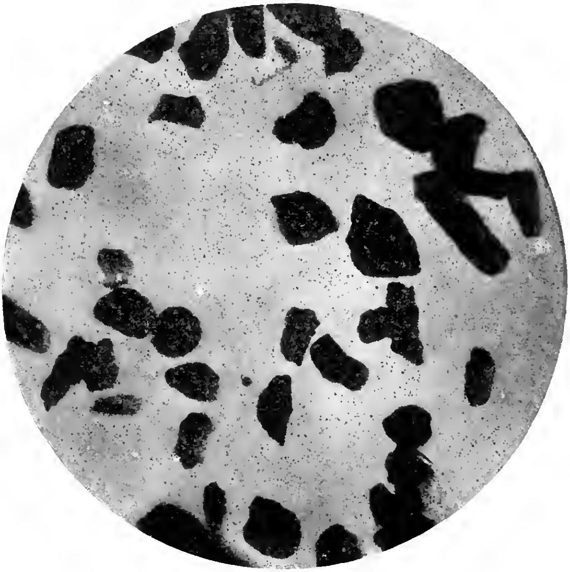
WHITE LEAD.

Courtesy of Henry A. Gardner.

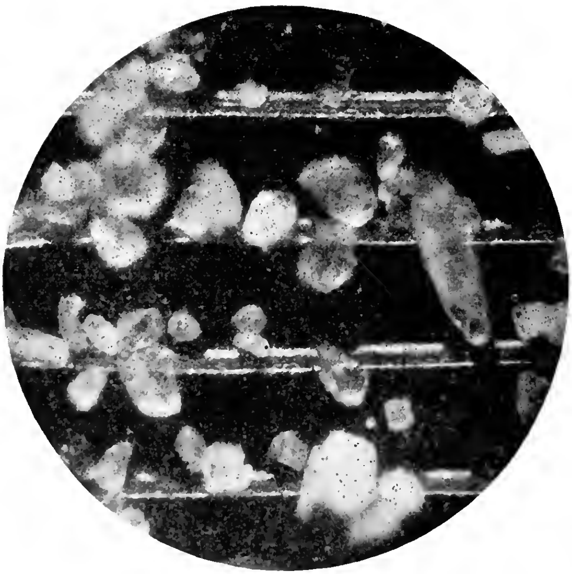
MERCURIC OXIDE
(globules of mercury were also present, but do not appear in the photograph).
Courtesy of Henry A. Gardner.



BARIUM SULPHATE.
Courtesy of Henry A. Gardner.



BONE BLACK.
Courtesy of Henry A. Gardner.



OCHRE.
Courtesy of Henry A. Gardner.

COMPOUND DIGESTIVE ELIXIR.*

By Ivor Griffith, Ph. M., Philadelphia.

"A therapeutic monstrosity and a pharmaceutic crime"—so was this elixir labelled by a professional satirist of the past decade. A monstrosity and a crime simply because the originator of this palatable elixir erred in theory at least by combining pancreatin and malt diastase (erswthile active only in alkaline media) with pepsin in an acid vehicle. And to add a finishing touch to the error, he also used a goodly portion of the enzyme killing alcohol, to further the elegance and the permanence of the preparation.

In the first instance, as is true of many other preparations of this kind, the elixir was only patterned after a proprietary, and if imitation is the sincerest form of flattery the original elixir, still in great vogue by virtue of its unremitting advertising and its no inconsiderable merit, is being greatly flattered to this day. For when the compilers of the third National Formulary decided to include the Compound Digestive Elixir in the official list of that authority they hardly expected for it the popular reception which it received at the hands of prescribing physicians.

This popularity came to it because of a combination of happy coincidences. Firstly, it boasted just the right shade of pleasing warmth, the red of an honest man's blood. Secondly, its odor, its bouquet and its taste, were delightful and oddly masked the noxious doses so often hidden among its molecules. And lastly, it was alleged by venturesome and opinionated pediatricians to be possessed of no mean merit as a stomachic and digestive in the treatment of disorders of that important part of the small child's anatomy. It helped to restore normalcy to the jaded stomachs of overfed babies, and to bring back equilibrium to small families whose first-born responded to colic impulses by singing alone but together the heroic sextette from "Lucia."

And any medicine that does this is entitled to a prominent place in the sun.

However, along came the new National Formulary Committee, and, because of certain theoretical considerations and in order to furnish professors of pharmacy some additional small talk, it promptly decided to forever disbar this horrid monstrosity from the revised

*Reprinted from *The Pennsylvania Pharmacist.*

edition. Thus with one fell stroke they expected that this elegant galenical freak would vanish with thin air.

But the best laid plans of mice and men "gang aft agley thegither" (which is Scotch for saying that the bottom dropped out of them). Doctors who had grown to love this ruddy elixir continued to prescribe it and the propaganda which the corner druggist had carried on when the elixir first became official, had taken deep root. So this elegant freak, now without a home or sponsor, manages to exist and carry on.

But it is no longer official, it is an outcast and outcasts have no codes of morals or ethics. So it is that we find no uniformity in the digestive elixirs that are still ruddy, for color is cheap, but are lacking in enzymes and alcohol, for these things are of worth. We venture to state that no two stores in a community supply a standard article, and that there is a greater variety of compound digestive elixirs parading the drug stores than there is of moonshine fluids stored in garages. Even the reputable drug manufacturers camouflage the issue, for none of them supplies in their catalog the accurate analysis of the succedaneum preparation, elixir of lactated pepsin, which they supply when compound digestive elixir is called for. They do say that it represents a "palatable combination containing 40 or 80 grains of lactated pepsin to each fluid ounce."

Just what lactated pepsin is one cannot quite see for elsewhere in the catalog it is vaguely described as a blended combination of pepsin, pancreatin and diastase with diluent. No figures of proportion are even given and one wonders whether this is an unimportant detail left to the judgment of the stock room employees whose stated proportions vary according to the state of the weather.

"If the doctor prescribes red brick dust it is the business of the pharmacist to prescribe standards for the article and to abide by them." So runs a statement attributed to Dr. Horatio Wood, Sr., and it is well said.

Irrespective, therefore, of the new restrictions proposed by the internal revenue authorities, who lay down prohibition rulings, and because of the persistent demand by doctors for this red elixir, the committee now functionating in revising the National Formulary is urged to re-introduce into that collection of worthy formulas the old formula for Compound Digestive Elixir, making no change in the name and omitting only the tincture of cudbear, replacing that with two drachms of powdered cudbear to the gallon.

SCIENTIFIC AND TECHNICAL ABSTRACTS

A Starch Indicator Solution.—After considerable experimenting with starch solutions and pastes a method was devised for preparing a compound containing starch which is very stable and not liable to decompose readily. The indicator was required to detect the presence of nitrites in water, for use in the Hübl and Wijs determinations, and to indicate the presence of free and combined iodine generally.

It was prepared as follows: Common household (rice) starch was boiled with about an equal weight of sodium carbonate in solution, and the resulting mixture allowed to cool. Concentrated hydrochloric acid was then added until all action had ceased and the liquid was distinctly acid. Pieces of granulated zinc were then placed in the liquid, and it was allowed to stand for about twenty-four hours. It was filtered when neutral.

When prepared from pure materials the solution is perfectly clear and colorless, but in most cases impurities in the starch give the indicator a yellow tinge.

A solution prepared in this way on July 8, 1921, still (March, 1922) gives a very distinct blue color when tested in the following manner: The starch solution (0.1 cc.) is placed in Nessler cylinder and diulted to 100 cc. with distilled water. The same quantity (0.1 cc.) of a 0.1 *N* iodine solution is then added, and the solution stirred with a glass rod.

Mucilage of Starch B. P., prepared from the same starch, when tested in the above manner, gave no reaction after keeping for ten days, whereas the other solution still reacts after keeping for over seven months.—(W. J. P., from the *Analyst,* April, 1922.)

Decomposition of Ammonium Nitrate.—Interest in this subject has been developed of late, owing to the great explosion at Oppau, the cause of which has not been determined, or if determined by the German experts, has not been definitely published. Suggestions have been made that it was in part due to ammonium compounds. The

formula of ammonium nitrate indicates that it may be an explosive if the proper initiative is applied. At a moderate temperature it decomposes almost wholly into water and nitrous oxide, a procedure that has been used for many years on a very large scale for the manufacture of the well-known anesthetic. It has been noticed, however, that irregular reactions often take place, especially the formation of small amounts of nitric oxide, and for commercial purposes the gas is always carefully purified. H. L. Saunders (*Jour. Chem. Soc.*, April, 1922, 698) gives the results of careful studies of the decomposition of the salt, finding that over a range of from 210° to 260° C., the course of decomposition is unaltered, about 98 per cent. of the salt decomposing into nitrous oxide and water, but a small amount of free nitrogen is always present. At a temperature of 300° the decomposition occurs explosively, and large amounts of nitrogen are set free. The reactions under the explosive decomposition are quite different from those which occur at the lower temperatures (quiet decomposition), producing nitric oxide, nitrogen peroxide and nitrogen in the ratio 2:4:5. Chlorides, which are often present in commercial samples, influence very unfavorably the action, free chlorine being almost always found in the gas. Chlorides accelerate the evolution of gas. The higher the initial temperature of decomposition, the lower the proportion of nitrous oxide. A certain amount of liquid is obtained, which always contains nitric acid, and also hydrochloric when chlorides are present in the salt used. Sulphates are without special influence, and small amounts of sodium nitrate—a not infrequent impurity of the commercial salt—do not influence the decomposition below 250°.

H. L.

PLATINUM CONDITIONS.—The enormous advance in the price of this metal in late years has proved very embarrassing to chemists and to several industries. This advance has unfortunately contributed to additional difficulty, because it has diverted the metal to a use for which it is really not adapted, namely jewelry. There is no reason to doubt that the practice of setting precious stones in platinum has been adopted because of the high cost of the material, for it has a poor lustre and does not set off the stone as well as gold. George F. Kunz has recently reviewed the conditions of the platinum supply and uses, and some of the data that he sets forth are here noted, being

taken from recent issues of the *Chemical News*. The industry is gradually emerging from the chaotic condition into which it was plunged by the war, and even the Russian sources are beginning to be active. A notable increase of production is also recorded in Colombia, the locality, by the way, in which the metal was first detected. The Colombia mines were actively exploited while the Russian mines were blocked, but American companies are now endeavoring to stabilize the South American sources. The price of the metal has fallen somewhat, though still very high. An increased demand for jewelry and dental work has arisen since the close of the war which tends to keep up price. In 1920, the consumption of platinum in the United States was 141,041 troy ounces, of which 57 per cent. was taken by jewelers, 19 per cent. by electrical industries, 11 per cent by dental industries, 10 per cent. by chemical operations, the remainder being distributed in minor lines.

Naturally, active search has been made for new platinum deposits, but so far no great rewards have come. Kunz states that the outlook for some Alaska exploitations is rather encouraging. In Colombia, the principal deposits are in the Atrato and San Juan rivers, but a third river is regarded as likely to yield a supply. The United States is about to pay Colombia a large sum as indemnity, and it is hoped that much of this will be used to develop some of the Colombian industries, especially the platinum deposits. Undoubtedly a marked fall in the cost of platinum will be of great advantage to chemists.

H. L.

MEDICAL AND PHARMACEUTICAL NOTES

Antiseptic Action of Coal-Tar Dyes.—At a recent meeting of the Society of Chemical Industry at Manchester, the facts concerning the extraordinarily potent antiseptic properties possessed by many of the coal-tar dyes was discussed. Bechhold and Ehrlich, in 1906, studied the antiseptic action of halogen compounds of phenol and naphthol, and obtained results which show clearly the extraordinary variations in antiseptic action produced by slight changes in chemical constitution, and also the markedly specific action of some

compounds. These points are illustrated by stating the minimal lethal concentration for certain micro-organisms of three closely allied naphthol compounds: dibrombetanaphthol is fatal to *B. coli* in a concentration of 1 : 30,000, and to *B. diphtheriæ* in one of 1 : 40,000; tribrombetanaphthol kills *B. coli* in a concentration of 1 : 2,000, and *B. diphtheriæ* in one of 1 : 400,000; tetrabrombetanaphthol has a lethal action on *B. coli* in a concentration of 1 : 1,000, and on *B. diphtheriæ* in one of 1 : 200,000.—(*Jour. Amer. Med. Assoc.*, June, 1922.)

Identification of Alkaloids Under the Microscope From the Form of Their Picrate Crystals. B. E. Nelson and H. A. Leonard.—Alkaloids may frequently be identified by the crystalline form of their picrates, but, in preparing such crystals for microscopic examination, it is essential that the conditions shall be the same in all cases. The most convenient procedure is as follows: A slight excess of saturated picric acid solution is added to a solution of the alkaloid acidified with hydrochloric acid, in a test tube; the precipitate is centrifuged, washed slightly, dissolved in a minimum quantity of warm 95 per cent. alcohol in a water bath, and allowed to cool slowly in the bath, with further cooling, if necessary. After centrifuging, the mother liquor is poured off, and the crystals transferred to a ringed cell microscope slide. A second crop of crystals is obtained by warming and cooling the alcoholic solution, after dilution to 50 per cent. Crystals so obtained may be compared with those from known alkaloids. Drawings of the crystalline picrates of the following are given: Atropine, eucaine, cinchonidine, hydrastine, sparteine, brucine, nicotine, scopolamine, hyoscyamine, pilocarpine, cinchonine, strychnine, morphine, heroin, homatropine, physostigmine, codeine, cocaine, dionin, quinidine, berberine, quinine, aconitine, caffeine and theobromine.—(*J. Amer. Chem. Soc.*, 1922, 44, 379-373. Through *The Analyst.*)

H. E. C.

New Sources of Cantharidin. C. van Zijp.—Cantharidin, which, according to the Pharmacopœias, may be obtained from various species of *Cantharis* or *Mylabris*, has now been isolated from two other species of beetles indigenous to Java. *Horia debyi Fairm.* (= *Cissites testaceus auct.*) ranges in length from 16 to 30 mm., and

in breadth from 5 to 10 mm., and is of a brick-red color. The other species, *Cissites maxillosa,* is much greater in size, but of the same color. Cantharidin may be separated from the male or female, or from the eggs, by moistening the finely divided material with strong hydrochloric acid, followed by sublimation, and evaporation of any condensed acid by exposing the sublimate over unslaked lime. In addition to their vesicating property, m. p., and polarizing action upon light, the crystals may be identified by their behavior with baryta water.—(*Pharm. Weekblad.,* 1922, 59, 285-289. Through *The Analyst.*)

INSECT POWDER.—The Insecticide and Fungicide Board of the United States Department of Agriculture recognizes as insect powder an insecticide made from the powdered flower heads of *Chrysanthemum cinerariæfolium, C. roseum* and *C. Marshallii.* The authors discuss the history, cultivation, harvesting, preparation of the powder, its effect on insects and animals and its adulteration. A long list of substances which have been used to color and adulterate insect powder is included together with physiologic, microscopic and chemic methods for the detection of the genuineness of insect powders. The presence and approximate percentage of stems may be determined by estimating the nitrogen, phosphorous and crude fibre together with a qualitative ether-extract test (to determine color). The ash content is highest in closed flowers, next highest in open flowers, and lowest in the stems. The analyst can determine whether open or closed flowers have been used in the following ways: The presence of a large amount of pollen and the absence of fruit tissue indicate "closed flowers"; and conversely, the absence of much pollen and the presence of a large amount of fruit tissues indicate "open flowers." (2) Mixtures of flowers and stems are made up on the basis of lowest cost. By following the market prices on "closed" and "open" flowers and stems, the analyst can usually tell which has been used in preparing a mixture of flowers and stems. (3) From the intensity of the green color of the ether extract, after experience the amount of stems present can be told roughly. (4) The crude fibre determination, taken in connection with the intensity of the green color of the ether extract, general appearance of the powder and odor, serves as a good indicator as to whether or not the mixture is

composed of "open" flowers and stems or "closed" flowers and stems.

The results of a series of tests show that the insecticidal activity of the insect powder is due to a mixture of acids and esters.—(*U. S. Dept. Agric. Bull.*, 824, 1-100, Pl. I-IV, 1920. C. C. McDonnell, R. C. Roark and G. L. Keenan.)

HEBER W. YOUNGKEN.

THE ADULTERATION OF INSECT POWDER WITH POWDERED DAISY FLOWERS.—Of all the species of *Chrysanthemum, C. Leucanthemum* probably has been one of those most often utilized for the sophistication of insect powder and its presence in commercial insect flowers has been frequently detected by the authors. The uses, insecticidal action and chemistry are taken up. The results of a comparison of analyses of the different commercial grades of insect flowers ("open" and "closed") and insect flower stems with those of the flowers of *Chrysanthemum Leucanthemum* show that phosphorous, pentosans and ash are higher in the flowers of *C. Leucanthemum* than in those of *C. cinerariæfolium.* After presenting the gross structure and histology of daisy flowers, the authors state that a chemical analysis is insufficient to show adulteration of insect powder with daisy flowers. This adulteration can be definitely determined only by microscopic examination. Powdered daisy flowers are distinguished by the irregular dark-red fragments of the achene and the palisade-like cells comprising the costal tissue of the akene.—(*U. S. Dept. Agric. Bull.*, 795 1-12. 9 fig. 1919. R. C. Roark and G. L. Keenan.)

HEBER W. YOUNGKEN.

INTRAVENOUS USE OF QUININE IN MALARIA.—Limitations to the use of quinine intravenously in malaria treatment is the subject of a report by Dr. K. F. Maxcy just published by the U. S. Public Health Service.

When quinine is given intravenously by routine in malaria treatment it can hardly be claimed that the procedure is without danger. The sudden introduction of a concentrated solution into the blood stream tends to cause circulatory depression and distressing nervous phenomena. Accidental extravasation into the tissues at the point of injection is apt to cause local necrosis and sloughing. Against these

dangers is the unquestionable rapidity with which the drug is brought into contact with the parasites in the blood stream. Except for this there is no clear evidence at present that in ordinary malaria infections the method is more effective than mouth administration in curing an acute attack, in ridding the blood of sexual forms, or in preventing relapse.

Its proper field of usefulness seems to be upon urgent clinical indications of two sorts: first, in cases in which prompt absorption by the gastro-intestinal tract, following mouth administration, is not to be expected because of violent gastro-intestinal disturbance or other cause, or in which it is impossible to give the drug by mouth on account of delirium, coma, etc.; and second, in cases which are gravely ill when first seen by the physician and in whom it is deemed imperative to secure immediate cinchonization. It does not seem necessary nor desirable to use the intravenous route of administration in the simple acute or chronic infections ordinarily encountered, whether tertian or æstivo-autumnal.

When the clinician decides that the method is warranted, the effect upon the patient must be borne in mind. Particularly is it necessary to be sure that the patient is not already suffering from circulatory embarrassment. The technique of the injection must be such as to minimize the danger of untoward effects by observing three cardinal principles: Careful aseptic technique; giving the drug in moderate doses and in dilution; and introducing the solution slowly.

All the precautions which are observed in giving a dose of salvarsan should be observed in giving quinine.

THE CAMPHOR OUTLOOK.—The recently published work of Brooks on the "Non-Benzenoid Hydrocarbons," devotes considerable space to the camphor problem, in relation to the practicability of the synthetic product competing with the natural. The large tree, *Cinnamomum camphora,* is the only source of the natural article, and the process of distilling with steam the chipped wood of mature trees has been carried out in China and Japan for several centuries. Japan has acquired control of practically all of the region occupied by these trees, and the price of camphor has been deliberately advanced, which gave occasion to earnest efforts to produce it artificially. The

greatly increased use of camphor owing to the development of the manufacture of celluloid, still further much increased by the demand for photographic film, has added to the importance of this supply, as has also the demand for transparent windows for automobiles.

For the production of synthetic camphor, the successful methods employ turpentine or pinene as raw material, and, unfortunately, while the primeval camphor forests of Asia are being rapidly reduced, the American turpentine trees are also disappearing. Dr. Brooks expresses the hope that the substitution of light petroleum products in the paint and varnish industries will conserve much of the supply of turpentine. Efforts have been made to cultivate camphor trees, but the substance does not exude from the tree as does turpentine. The woody material must be distilled with steam. The distillation of leaves has not proved profitable. Considerable planting of camphor trees has been done in Florida and California, as well as in some part of the East Indies. Synthetic camphor is prepared from turpentine by conversion into bornyl chloride, the principal source of which is the long-leaved pine, *P. palustris*. The turpentine should be fresh, as old turpentine gives a low yield of bornyl chloride. Borneol, from which bornyl chloride is prepared, exists in Borneo camphor, but the supply from this source is not sufficient.

In this connection, however, a timely suggestion for increasing the yield of turpentine is presented in a paper by W. H. Mason, Laurel, Miss., which was read before the Southern Pine Association, and abstracted in *Building* (Phila.). Mason has carried out on a large scale, with much success, two processes for extracting turpentine, pine oil and rosin from sawed lumber. In one the drying is conducted mainly as in the ordinary dry-kiln, but in the first twenty-four hours steam is used instead of air, and the vapors are led to a condenser. The condensed liquid consists of water and turpentine, which are separated. It is found that the lumber is dried better and more thoroughly, with less warping and will hold paint better. The process has been in use for more than a year. The yield on long leaf pine is about one gallon of turpentine per 1000 feet; on short leaf pine about half this.

In the second method, called "pitch extraction" only the pitch is treated. A grading expert marks the "fat" pieces, which are run into a special retort with steam coils in the bottom. Turpentine is

run in and boiled up, by which the pitch is extracted and water driven out. The solvent liquor is sent to the refining plant to recover the constituents.

H. L.

PASTEUR CENTENNIAL.—Commemoration of the centennial anniversary of the birth of Pasteur will be the occasion of the erection of a statue facing the Strasbourg University, where, as a professor, he began his career. The inauguration ceremonies will take place on May 1, 1923, under the patronage of the Republic, and will consist principally in the unveiling of the statue and the opening of an exhibition of hygiene and bacteriology. This exhibition will be mainly arranged to show the advances made in these subjects as a result of Pasteur's work. A Congress of Hygiene and Bacteriology will be held at the same time.

In estimating the work of Pasteur, his earlier investigations into the phenomena of racemism must not be forgotten. His later work in the study of pathogenetic organisms has overshadowed to a certain extent his labors in physical science, but these were epoch-making. His investigations extended over many years, the results appearing, from time to time, in French journals, with more or less extended abstracts in the journals of other countries, but in the early part of 1860 he delivered, by request, before the Paris Chemical Society two lectures, in which he summarized his labors and set forth the interesting and highly important method of "mesotomization," that is breaking up the racemic association so as to secure one of the active constituents. He also called attention to the curious asymmetry of the crystals of some of these compounds. His experiments were conducted on the tartrates. The two lectures have been printed in English as No. 14 of the "Alembic Club Reprints," with the title, "Researches on the Molecular Asymmetry of Natural Organic Products." A translation into German has appeared as No. 28 of Ostwald's "Klassiker der exacten Wissenschaften."

It is to be hoped that the orators to whom will fall the lot to deliver the addresses on the occasion of the dedication of the statue, will not fail to lay some stress on the services which these early researches did to organic chemistry.

H. L.

SOLID EXTRACTS

Recent scientific evidence points to the existence of man upon this mundane sphere even prior to the great Ice Age. In terms of years this is counted as nearly one-half a million. The recent discovery of the Foxhall man near Ipswich, England, led to this assertion.

Galen, born about 129 A. D., complained that there were no real seekers after truth in his time, but that all were intent upon money, political power or pleasure, and that not five men of all those he had met preferred to be rather than to seem wise. "'Twas ever thus!"

Aluminum with 11 to 14 per cent. of silicon yields an alloy which is lighter than aluminum itself, stronger, more resistant, and more suitable for casting than known aluminum alloys.

Keiselguhr or diatomaceous earth, which has come into extensive use as a filtering and clarifying medium, is formed of incalculable millions of the fossil remains or siliceous skeletons of minute animals, who lived in ancient seas ages ago.

Bile salt (sodium taurocholate) is now used as a remedy for pediculosis. A solution of the salt in eucalyptol has been successfully used for this purpose.

Chlorophyll in plants is analogous in a great many respects to the hemoglobin of the red blood cell. Iron, which it the pivotal element in hemoglobin is absent in chlorophyll, magnesium being considered the important element there. Iron is, however, essential to plant metabolism and is particularly necessary in a synergistic way for the chlorophyll production.

Before the war all flasks for preparing typhoid toxine were made in Germany. When of necessity an American company had to make them, they were found to be far better than any flasks ever imported.

Did you know that carbolic acid is only slightly soluble in liquid paraffin. Only one per cent. dissolves in the paraffin, and any excess of this amount separates out as an oily layer in the bottom of the container.

The laboratory technician states that a pneumonic patient with a high leukocyte (white-cell) count has far better prospects of survival than one having a low or a normal white-cell count.

Medical men are now advocating inoculating all children with a biological product which will safeguard them against diphtheretic infection. No one wishes to offer an objection to such a procedure, if good results come from it, but life for little Johnny of the future will be nothing but "one darn inoculation after another."

Doctors are warning against the haphazard use of gland extracts, since so little is known regarding their standardization and physiologic effects. Yet we know certain patent medicines containing some of the potent gland substances and which are sold to the laity without discrimination.

NEWS ITEMS AND PERSONAL NOTES

Dr. R. W. Hickman Retires.—Dr. Richard W. Hickman, chief of the Quarantine Division, retired March 31 after thirty-four years of continuous service in the Bureau of Animal Industry.

Dr. Hickman was appointed a veterinary inspector March 31, 1888, on the force which was organized to combat contagious pleuropneumonia of cattle in the vicinity of Philadelphia, and December 11, 1888, he was transferred to the force operating in the vicinity of New York City, where the disease was most prevalent. He was conspicuous among those veterinarians, who, under the very unfavorable conditions, accomplished so successfully the first great task assigned to the new bureau, the eradication of contagious pleuropneumonia from the United States.

When, as a result of this accomplishment, the ports of Great Britain were reopened to our export cattle trade, Doctor Hickman was sent to the Union Stock Yards, Chicago, our greatest export cattle market at that time, to organize a system for inspecting export cattle and marking them for identification. May 1, 1892, he was placed in charge of the meat-inspection station at New York City. He was called to Washington November 1, 1900, to take charge of the Miscellaneous Division of the bureau, and July 1, 1905, he was appointed chief of the Quarantine Division.

Though a pharmacist, graduate veterinarian, and a specialist in veterinary education, Doctor Hickman is best known for his services in administering the Federal quarantine which has protected the live stock of the United States against destructive foreign plagues. He has drafted or revised most of the regulations regarding the export and import movement of live stock and is the author of important contributions to veterinary literature. He has also served on committees that were instrumental in placing the work of veterinary colleges on a high plane of instruction and equipment.

In entering upon his well-earned retirement Doctor Hickman carries the high regard and good wishes of his late official associates.

National Research Council News.—The National Research Council hs elected the following chairmen of its divisions for the year 1922-23:

Division of Foreign Relations—Robert A. Millikan, Foreign Secretary of the National Academy of Sciences, and Director of the Norman Bridge Laboratory of Physics, California Institute of Technology, Pasadena, California.

Division of Educational Relations—Vernon Kellogg, Permanent Secretary, National Research Council, Washington, D. C.

Division of Research Extension—W. M. Corse, formerly General Manager of the Monel Metal Products Corporation, Bayonne, New Jersey.

Research Information Service—Robert M. Yerkes, National Research Council, Washington, D. C.

Division of Physical Sciences—William Duane, Professor of Bio-physics, Harvard University Medical School, Boston, Massachusetts.

Division of Engineering—Alfred D. Flinn, Secretary, Engineering Foundation, 29 West Thirty-ninth Street, New York, N. Y.

Division of Chemistry and Chemical Technology—Edward W. Washburn, Professor of Ceramic Chemistry and Head of the Department of Ceramic Engineering, University of Illinois, Urbana, Illinois.

Division of Geology and Geography—Nevin M. Fenneman, Professor of Geology and Geography, University of Cincinnati, Cincinnati, Ohio.

Division of Medical Sciences—Frederick P. Gay, Professor of Pathology, University of California, Berkeley, California.

Division of Biology and Agriculture—F. R. Lillie, Professor of Embryology, University of Chicago, Chicago, Illinois.

Division of Anthropology and Psychology—Raymond Dodge, Professor of Psychlogy, Wesleyan University, Middletown, Ohio.

BOOK REVIEWS

AUGUSTE LUMIÈRE. Rôle des colloides chez les êtres vivantes. Pp. 311 + viii. Pl. 14. 13.5 x 18.5 cm. Paris, Masson et Cie, 1921.

The contents of this absorbingly interesting little volume can be epitomized in the three sentences which appear on page iii:

"The evolution and flocculation of the colloidal micella considered as bases of normal and pathological physiology.

"The colloidal state conditions life.

"Flocculation determines disease and death."

The work comprises eight chapters devoted to a discussion of the relations between the colloids of the organism and its physiological processes and pathological states, to which is added a most voluminous bibliography filling 150 pages and well indexed. Several of the plates are handsomely colored. Particularly interesting are the plates which illustrate the histology of anaphylaxis compared with that of barium shock.

The following quotations are selected from the summary and give a good idea of the contents of the book.

"The tissues of living beings are constituted, in large part, by colloids and the reactions of which they are the seat and which condition growth, nutrition, disease and death, owe obedience to the laws which govern the evolution of these colloids.

"All colloidal material is composed of micellæ, animated by the Brownian movement, which remain in suspension in a liquid. These micellæ are themselves formed of a nucleus or granule, that is to say of a certain number of molecules of an insoluble body in the intermicellar liquid, surrounded by a layer of another substance, soluble but fixed by adsorption, this last being the active portion of the micella.

"The micellæ evolve, mature, and tend toward flocculation through loss of the perigranular layer, through progressive enlargement, coalescence of nuclei and precipitation. When precipitation occurs, the colloidal state terminates at the same time as the Brownian movement.

"The phenomena which characterize life correspond to the continual exchanges between the adsorbed layer and the intermicellar liquid. These exchanges cease at the moment of flocculation.

"The surface of contact between the micellæ and the liquid medium in which they are suspended is larger as the micellæ are smaller. This surface at which the vital exchanges are effected, is enormous; for the adult man it corresponds to several millions or square meters.

"One must recognize two kinds of colloids in the organism; those which form the cellular protoplasm and those which constitute the extra-cellular liquids, circulating in the organism or entirely impregnating it.

"Flocculation of one of these colloids produces effects differing from those produced by flocculation of the other. When flocculation occurs in the body fluids it induces the symptoms common to many maladies; fever, phlegmasia, dermatoses, arthralgia, etc. When it occurs in cells of which the protoplasmic properties vary in different tissues the symptoms which are developed are, in general, characteristic of a specific disease.

"Foreign proteins occur in two well-differentiated types: a, those derived from pathogenic micro-organisms and which are able to flocculate colloids at once without previous preparation, flocculation which requires a variable period of incubation according to the species; b, the other type can react only after a specific preparation by the same protein. The latter are elaborated by saprophytic microbes or may be derived from the colloids of food.

"Infectious diseases correspond to the first type and chronic diseases to the second.

"It is in the desensitizing of patients impregnated through the accidental penetration of protein into the organism, searching for methods to hinder flocculation or to dissolve the precipitated materials, that one can hope to find the truly curative procedures for acute or chronic pathological states."

The book is very readable and the subject matter is well arranged. The style becomes sometimes a trifle involved due to packing of subordinate and modifying clauses into the sentences, but the author's idea is always clear and readily followed. If the hypotheses advanced in this work and in the similar book by Prof. Danysz,[1] which now have considerable experimental proof behind them, shall be verified and generally accepted they will open a large field for investigation and will give us a new and a simple point of view towards the whole subject of disease and death.

J. F. Couch.

[1] *The Evolution of Disease.* By Prof. J. Danysz. Trans. by Francis M. Rackemann, M. D. Lea & Febiger, Philadelphia and New York, 1921.

THE ELEMENTS OF FRACTIONAL DISTILLATION. By CLARK SHOVE ROBINSON. McGraw-Hill Book Co., New York. Pp. X-205. 16 x 20.5 cm. 1922.

In the preface to this admirable work the author says:

"Young's 'Fractional Distillation,' while a model for its kind, has to do almost entirely with the aspects of the subject as viewed from the chemical laboratory, and there has been literally no work in English available for the engineer and plant operator, dealing with the applications of the laboratory processes to the plant.

"The use of the modern types of distilling equipment is growing at a rapid rate. Manufacturers of chemicals are learning that they must refine their products in order to market them successfully, and it is often true that fractional distillation offers the most available if not the only way of accomplishing this. There has consequently arisen a wide demand among engineers and operators for a book which will explain the principles involved in such a way that these principles can be applied to the particular problem at hand."

The chapters are entitled:

I. The Phase Rule.
II. One Component System.
III. Two Component Systems.
IV. More Complex Systems.
V. The Gas Laws.
VI. Solutions.
VII. Concentrated Solutions.
VIII. Simple Distillation.
IX. Fractionation.
X. Rate of Fractionation.
XI. Discontinuous Distillation.
XII. The Design of a Continuous Still.
XIII. The Fractionating Column.
XIV. The Condenser.
XV. Acessories.
XVI. Continuous Distillation.
XVII. Ammonia.
XVIII. Benzolized Wash Oil.
XIX. Methyl Alcohol.
XX. Ethyl Alcohol.

This book will prove of great value to operators of distilling apparatus. The style of the exposition is simple and plain and should be readily comprehended by the better grade of plant operative. Mathematical treatment has, apparently, been avoided where possible, but in those instances where it is used it is given with commendable completeness.

The book ought to find much application in manufacturing pharmacy where so much distilling must be carried on. It should be consulted by every one who contemplates the purchase and installation of stills, condensers, columns for fractionation, and the numberless items which go to make up the distilling outfit.

To the scientific scholar, the careful and detailed treatment of the underlying theories, and the numerous reproductions of graphs and tables of data will prove of interest.

The book is well printed on excellent paper and is bound well.

James F. Couch.

THE AMERICAN
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EDITORIAL

"VIRTUALLY THE HISTORY OF AMERICAN PHARMACY."

So reads a caption used in calling the attention of the profession to the Historical Volume of the Philadelphia College of Pharmacy, now in press and shortly to be ready for distribution. And the phrase is significant and true. For it is well known that the first page of the History of American Pharmacy was written by the Apothecaries of Philadelphia when they established, in 1821, the College of Apothecaries, later the Philadelphia College of Pharmacy and still later the Philadelphia College of Pharmacy and Science.

The sturdy apothecaries of the City of Brotherly Love builded better than they knew, for as years merged into decades and the decades into a century, the College which they founded came to be recognized as the pre-eminent institution of pharmaceutical learning in the country. From its doors have gone thousands of trained men, many of whom have writ large their names upon the scroll of human service.

Pharmacy and the allied sciences owe much of their advance to the efforts of her graduates. In the service of the Federal and State governments graduates of this College have been of assistance in helping to bring about important legislation relating to pharmacy and the compounding and dispensing of drugs. The educating of pharmacists throughout the country at large has been well shared in by men who went out of this pioneer institution. Its contribution towards making the Pharmacopœia of the United States the peer of such books of official standards is no unworthy record.

In short, the history of this unique institution is the story of a progressive enterprise, progressive because of the foresight of its charter members and because of the unflinching adherence of those

who "carried on" to the straight-from-the-shoulder policies of its Quaker founders.

This Centennial History of the Philadelphia College of Pharmacy, to be issued by the College, records the story of the institution in an interesting and detailed fashion and no pharmacist or pharmaceutical manufacturer or any one connected with the profession can afford to be without a copy. The work is appropriately and profusely illustrated, many of the pictures being taken from rare prints, photographs and paintings. An idea of the comprehensive nature of this volume may be had by scrutinizing the following brief survey of its contents:

Chapter I—Philadelphia and Pharmacy in 1821.

Philadelphia in 1821, Pharmacy in 1821, Separation of Pharmacy from Medicine, Manufacture of Pharmaceuticals, Manufacture of Medicinal Chemicals, Manufacture of Technical Chemicals, Establishment of Drug Milling, Pharmaceutical Events in 1821.

Chapter II—Founding of the College.

Drug Standards, Importance of Pharmacy, Teaching of Pharmacy at the University of Pennsylvania, Institution of Master of Pharmacy Degree by the University, Reaction of Druggists and Apothecaries, First Meeting of the Druggists and Apothecaries, Appointment of a Committee on Plan, Recommendations of the Committee on Plan, Founders of the College, Administration of the College, Election of Officers of the College, Establishment of the School, Conferring of Master of Pharmacy Degree by the University, New College Meets Commendation, First Professors of the College—Jackson and Troost, First Home—German Society Hall (1821-1833), First Lectures of the College, Incorporation of the College, Early Days, Journal of the College, Druggist's Manual, Patent Medicine Abuses, Early Achievements.

Chapter III—In a Home of Its Own—Zane Street Building (1833-1868).

Wood, Bache, Early American Pharmacopœias, The First U. S. Pharmacopœia, Development of the U. S. Pharmacopœia, The First U. S. Dispensatory, Physical Development of the College, Develop-

ment of the American Journal of Pharmacy, Philadelphia—The Mecca of American Pharmacy, Early Pharmaceutical History.

Chapter IV—Ethical Standards and National Associations.

Griffith, Carson, Fisher, Bridges, U. S. Pharmacopœia of 1840, U. S. Pharmacopœias of 1850 to 1880, Instruction in Theoretical and Practical Pharmacy, Procter, Nostrum Traffic, Code of Ethics of 1846, Ethical Standards, Evolution of Drug Import Law, Enactment of Drug Import Law, Organization of the American Pharmaceutical Association, A. Ph. A. Conventions, Smith and Ellis.

Chapter V—From Zane Street to North Tenth Street.

Thomas, Parrish, Maisch, College Development, Larger Quarters Needed, Erection of the New Building in 1868, Courses of Instruction, Evolution of Pharmacy Laws, Local Pharmacy Laws, Fiftieth Anniversary of the College.

Chapter VI—Progress and Achievements of the Past Fifty Years.

Remington, Sadtler, Improvements in Instruction, Women Graduates in Pharmacy, Power, Trimble, Erection of Additional Buildings, Continued Growth of the College, Three-Year Courses, Bastin, Lowe, Kraemer and Moerk, Seventy-fifth Anniversary of College, Bullock, Jenks and French, Evolution of State Pharmaceutical Associations, Pennsylvania Pharmaceutical Association, Progress of Pharmaceutical Legislation, Pharmacy Law of Pennsylvania, Pre-Requisite Laws and Pharmaceutical Licensure, U. S. Pharmacopœias of 1880 and Later, Honors to Leaders of American Pharmacy, Responsibility for Public Health, Enactment of the Federal Food and Drugs Law, Enactment of State Food and Drugs Laws, Administration of the Federal Food and Drugs Law, Narcotic Laws, Food and Drugs Course (1907), The First Commercial Training in Pharmacy, Faculty Changes, Merging of Department of Pharmacy of the Medico-Chirurgical College, Text Books Issued by the Faculty, Service of the College in the World War, Graduates of Pharmacy in Pharmaceutical Journalism, Changes in the Courses and Degrees,

Bachelor of Science Courses, Honorary Degree of Master in Pharmacy, Degree of Master in Pharmacy in Course, The Spirit of Research, The Master Research Workers of American Pharmacy, The Practical Value of Research, A Specialized Scientific School, Library, Museum, Botanical Gardens, Scholarships, Fellowships and Prizes, Administrative Changes in 1921.

Chapter VII—Alumni Association of the College; Its Origin and Work.

Chapter VIII—Merging of the Department of Pharmacy of the Medico-Chirurgical College With the Philadelphia College of Pharmacy.

Chapter IX—Alumni Association of the Department of Pharmacy of the Medico-Chirurgical College.

Chapter X—American Journal of Pharmacy.

Chapter XI—Centennial Year.

Committee on Centennial Celebration, Founders' Day Exercises, Centennial Celebration Week, Centennial Exercises, Centennial Reception and Banquet, Commencement Day, Endowment of the College, The Dawn of a New Era in Scientific Pharmacy, Co-operative Research in Pharmacy and Medicine.

Chapter XII—Officers, Trustees, Executives and Faculty of the Philadelphia College of Pharmacy.

Chapter XIII—Biographical List of Graduates of the Philadelphia College of Pharmacy, and of the Department of Pharmacy of the Medico-Chirurgical College.

A blank for the convenience of prospective subscribers is furnished elsewhere in the advertising pages of this issue.

I. G.

ORIGINAL PAPERS

MODERN ILLUMINATION OF AGE-OLD PROCESSES.*

By F. P. Stroup, Ph. M.

Professor of General Chemistry, Philadelphia College of Pharmacy and Science.

This paper is an attempt, on the part of the author, to bring to his hearers and readers, in as simple language as he can command, an interpretation of the meaning of some of the terms which they are meeting every day in their scientific and semi-scientific literature. He will be amply rewarded if, as the result of this effort, a few persons will be able to read with pleasure and profit more of the articles and discussions published in books and periodicals than they could read intelligently heretofore.

Chemical processes have been going on since time began, each one in its own particular way. When man came upon the stage he, doubtless, began to take notice of many of these processes, and, being a reasoning animal, began to try to explain how and why chemical changes took place. Chemical phenomena have not changed through the ages, but man's interpretations of them have been changing constantly. During the less than fifty years of the existence of this Association there have been wonderful changes, in a forward direction, of means for the production of artificial illumination, and man has not been slow to adopt each new or improved method as it was brought to his attention. During the same period there have been no less wonderful changes in man's conception of the why and wherefore of natural processes, essentially chemical, yet many persons have been very slow to change from the ideas they formed when they first studied chemical science. Despite the fact that the new ideas explain simply and satisfactorily many phenomena inexplicable by the older theories, there are still many persons who seem to reason "the old is good enough for me," and many who regard the new as "highbrow stuff," too complicated for any but the best equipped (from the mental standpoint) to master. The first attitude of mind we cannot

*Read at the 1922 Meeting of the Pennsylvania Pharmaceutical Association.

combat, but we are going to attempt to show that much of this so-called "high-brow stuff" is capable of being easily understood. Instead of following the conventional free lecture style to "get our message across" we are going to conduct a quiz, using hypothetical questions answered by as direct answers as we can give.

QUESTION: What is meant by the terms "Ionization" and "Electrolytic Dissociation"?

ANSWER: These are terms given to the change which many compounds are believed to undergo when they dissolve in certain liquids, particularly water. According to the Ionic Theory

Acids, in the presence of water, yield positively charged hydrogen (H) ions (Hydrion) and negatively charged simple or compound anions, each acid having its characteristic anion.

$$HCl = H^+ + Cl^-; \quad HNO_3 = H^+ + NO_3^-;$$
$$H_2SO_4 = H^+ + H^+ + SO_4^{--};$$

Bases, in the presence of water, yield negatively charged hydroxyl (OH) ions (Hydroxidion) and positively charged simple or compound cations, each base having its characteristic cation.

$$KOH = K^+ + OH^-; \quad NH_4OH = NH_4^+ + OH^-;$$
$$Ca(OH)_2 = Ca^{++} + OH^- + OH^-;$$

Salts, in the presence of water, yield positively charged cations and negatively charged anions, other than Hydrion and Hydroxidion, the composition of which are dependent upon the acid and base to which the salt, in each case, is chemically related.

$$NaBr = Na^+ + Br^-; \quad NH_4H_2PO_2 = NH_4^+ + H_2PO_2^-.$$

Q. Solution having been effected, is ionization complete?

A. No, except in dilute solution and, even then, it depends on the nature of the compound dissolved. In very concentrated solutions the degree of ionization may be practically nil. There is greater uniformity among salts as regards degree of dissociation than among acids and bases. Certain acids (hydrochloric, hydrobromic, hydriodic, nitric, sulphuric, for example) ionize quite freely in comparatively concentrated solution, and completely in dilute solution, and, because of this fact, are called "strong acids"; while other acids (phosphoric, hydrofluoric, boric, carbonic and most organic acids, for example) ionize but sparingly, even in very dilute solution, and are

known as "weak acids." Bases which ionize freely (the hydroxides of potassium, sodium, calcium, barium and strontium, for example) are called "strong bases"; while those which ionize sparingly (the hydroxides of ammonium and most of the metals, and the alcohols, for example) are called "weak bases." Most salts, even those related to "weak bases," "weak acids," or both, ionize quite freely, though not so strongly as the "strong" bases and acids.

Q. Why is it that concentrated sulphuric acid may be stored and shipped in iron containers, while the diluted acid cannot?

A. The acid properties of an acid are dependent mainly upon the H ions which it liberates in the presence of water. The concentrated acid is not ionized and so has no effect on the metal, while the diluted acid contains H ions which can and do give up their positive electric charges to atoms of iron which then become ions and go into solution. The hydrogen atoms combine to form molecules of the element, which are gaseous at ordinary temperatures.

Q. Why do some acids seem less sour in taste than others, even when of the same alkali-neutralizing power, and why do some acids (boric, for example) taste not at all sour?

A. The sour taste is due to H ions. "Strong" acids (hydrochloric, for example) contain more H ions per unit of volume than "weak" acids (acetic, for example), hence have a more intense taste. Boric acid ionizes so slightly in the saliva and produces so few H ions that their taste is not perceptible.

Q. Why do aqueous solutions of some salts (the carbonates, normal phosphates, borates, silicates, acetates and other organic salts of potassium and sodium, for example) have an alkaline reaction?

A. Because the water has brought about a so-called "hydrolytic dissociation," followed by ionization, resulting in a predominance of OH ions, the cause of alkalinity. Example: Sodium carbonate, in the presence of water, forms some sodium hydroxide and an equivalent amount of carbonic acid. $Na_2CO_3 + 2H_2O = 2NaOH + H_2CO_3$. The former ionizes more strongly than the latter; result, an excess of OH ions. Where hydrolytic dissociation (also called "hydrolysis") results in the formation of a "strong" base and a "weak" acid the resulting solution is always alkaline.

Q. Why do solutions of some salts (the chlorides, nitrates, sulphates of zinc, aluminum, copper and iron, for example) have an acid reaction?

A. For the reason given under the previous question, except that the result of the hydrolysis in each instance is a "weak" base, yielding few OH ions, and a "strong" acid, yielding many H ions,—a preponderance of H ions, the cause of acidity.

Q. How does the Ionic theory explain neutralization reactions?

A. The H ions of the acid solution and the OH ions of the alkali solution combine to form un-ionized water, the anions of the acid and the cations of the alkali remaining, for the most part, in solution until the solvent is removed by evaporation, or otherwise, when they combine to form a salt. $Na^+ + OH^- + H^+ + Cl^+ = H_2O + Na^+ + Cl^+$. As fast as H ions and OH ions combine others are liberated from the acid and alkali, respectively, until both have been completely dissociated and the resulting H and OH ions have all combined as water.

Q. Does water not ionize at all?

A. Chemically pure water has never been obtained, because of the solvent action of this substance on the gases of the air and other gases, as well as on all solids which might be used in the manufacture of containers; but it has been calculated that ten million liters of chemically pure water, at ordinary temperatures, would contain 1 gram (1.008, to be exact) of H ions and 17 grams (17.008, to be exact) OH ions. Its hydrogen ion concentration would be ten-millionth normal, or 10^{-7}, or pH_7, or P_{H_7}. Its hydroxyl ion concentration could be expressed in the same way. Water of this purity would represent absolute neutrality; the H ions would exactly balance the OH ions. $H_2O = H^+ + OH^-$.

Q. What is meant by the term "normal" as applied to solutions used in volumetric chemical analysis?

A. A normal solution of an acid contains in each liter one (1.008, to be exact) gram of acidic hydrogen, not necessarily as H ions; a normal solution of an alkali contains in each liter 17 (17.008) grams basic hydroxyl, not necessarily as OH ions. A given volume of any normal alkali solution will just exactly neutralize an equal volume of any normal acid solution. A normal solution of any compound, other than acid or alkali, contains in each liter, or is capable of liberating from each liter, an amount of oxygen or some other element chemically equivalent to one gram of hydrogen.

Q. What is meant by the term "Hydrogen Ion Concentration"?

A. The strength of a solution or mixture in terms of H ions. One gram of H ions in a liter is a normal solution, one gram in ten liters (or 100 milligrams in one liter) is a decinormal solution (tenth normal).

Q. Is there not a better system of nomenclature than this? It would seem that this system, being used as it is in the naming of volumetric solutions, would lead to some confusion.

A. Your point is well taken. One or another of several other systems is generally used. In one system a normal solution is designated numerically as 1.0; a decinormal solution, 10^{-1}; a centinormal solution, 10^{-2}; a ten-millionth normal, 10^{-7}, etc. By another system a normal solution is designated as 1.0; a decinormal solution by pH_1 or P_{H_1}; a centinormal solution by pH_2 or P_{H_2}; a ten-millionth normal solution by pH_7 or P_{H_7}, etc.

Q. What is the difference in the use of the term "normal" as applied to volumetric solutions and the same term as applied to the H ion concentration of a solution or mixture?

A. This question, perhaps, can be best answered by use of a non-chemical illustration, followed by a concrete chemical example. A normal army may have in it 10,000 men,—a fighting line of 1,000, backed up by the other 9,000. The fighting is done by the thousand in the front lines, and only as some of them drop out do the others get a chance to fight. The thousand represent the fighting-man concentration, the ten thousand the total man concentration of the army. Six per cent. Acetic Acid corresponds to Normal Acetic Acid Volumetric Solution (it contains in each liter 60 grams absolute acid [Molecular Weight of Acetic Acid is 60], of which one gram is *acidic* hydrogen). But six per cent. Acetic Acid is only about 10 per cent. ionized, hence its H ion concentration is only about one-tenth of its acidic hydrogen strength; so, while acid of this strength is *normal* for volumetric analytical purposes, its H ion concentration is only *decinormal*, 10^{-1}, or P_{H_1}.

Q. Why the negative exponent in 10^{-1}, 10^{-2}, 10^{-7}, etc.?

A. It is the mathematical method of expressing the reciprocal (opposite) of the power of a number. Illustration: 10^2 means 10 raised to the second power, or 100; 10^{-2} is the reciprocal, or 1/100th.

Q. I have noted that fiftieth normal is expressed as $10^{-1.7}$ or $pH_{1.7}$. Is that not a mistake? Should it not be 1.5?

A. The figure is correct. It is the logarithm of the number which is the denominator of the fraction which indicates the concentration.

1 is the logarithm of 10, 1.7 is the abbreviated log of 50, 1.9 is the abbreviated log of 80, and 2 is the log of 100.

Q. You have said that absolute neutrality is represented by pH_7. What, then, is meant by pH_{12}?

A. The product of the H ions and OH ions in any sample of water is a constant. If more OH ions be added, say by the addition of some KOH solution, the increase of OH ions is compensated for by a decrease of H ions, and the product of the two remains unaltered. The alkalinity of a solution can thus be expressed in terms of acidity (H ion concentration). A normal alkali solution has a pH value of 14, and a centinormal solution of alkali can be rated as pH_{12}. It will be seen that the higher the figure the lower is the H ion concentration. A change of one integer downward means a change of ten times the strength upward.

Q. How may the H ion concentration of a solution or mixture be determined?

A. A very accurate and quick method, one which has many advantages over any other known method, depends upon the use of electrical apparatus by means of which the conducting power of the solution or mixture is determined. The expense of the apparatus is the chief drawback to its general use. A much cheaper method, one which is sufficiently accurate for most purposes, depends upon the use of a series of so-called "indicators," each of which changes color within a fairly narrow range of H ion concentrations. For example:

1. Bromphenol blue is yellow at $pH_{2.8}$ and blue at $pH_{4.6}$;
2. Methyl red is red at $pH_{4.4}$ and yellow at $pH_{6.0}$.

Suppose that separate portions of a solution have been tested with these two indicators, and the portion with No. 1 shows blue, and the one with No. 2 shows red. The conclusion must be that the H ion concentration of the solution is between 4.6 and 6.0.

Q. What is a so-called "Buffer"?

A. A substance which prevents more than slight, if any, change in the H ion concentration of a solution when acid or alkali is added

to a solution or developed within it. One drop of a weak solution of hydrochloric acid added to pure water may alter the pH value several integers. Should sodium phosphate or sodium bicarbonate be present, the effect would be slight. Alkali phosphates, carbonates, borates and citrates are among the best buffers. Proteins and amino-acids also are good, and these are among the natural buffers that are found in animal fluids, and help to keep biological processes from being disturbed by the formation of acids through errors in diet, disease, etc.

Q. Can you give us some instances where correct H ion concentration determines the success or failure of a process?

A. Factors which disturb the H ion concentration of the blood and other body fluids lead to ill health and, often, death. Micro-organisms of various kinds (bacteria, ferments) and even the higher plants, require culture media or soil of the proper H ion concentration for normal development. It has been suggested that traces of impurities in many compounds might be easily detected by use of H ion concentration measurement methods, particularly the electrolytic method.

ALCOHOL IN PHARMACY.

John Uri Lloyd, Ph. M., Cincinnati, Ohio.

"My Dear Mr. Editor:

"Perhaps I may best reply to the question you ask me regarding alcohol in pharmacy, by quoting from some of my old contributions to the *Eclectic Medical Journal,* which have not, so far as I know, drifted into pharmaceutical journalistic print. In some directions, as I read these over, revisions might be made, as is natural when one considers that the first was written forty-five years ago, but as a whole they might, in my opinion, stand as written.

"Believing that if you have the time to read these over they will practically cover the questions asked of me. I am

"Sincerely yours,

"(Signed) John Uri Lloyd."

Editor's Note.—Nearly a half century has rolled by since Professor Lloyd penned the following contribution, but we frankly believe with the Professor that these *old* writings carry much that just at present is considered as "new thought" and also much that will give text for "advanced thought" to persons concerned in therapeutic pharmaceutical progress.

Alcohol Adversely Criticised.*†

Unless the pharmacist has made himself as nearly as possible conversant with the properties and chemical attributes of the substances that are naturally associated within the bark along with the glucoside, and is consequently enabled in preparing his pharmaceuticals to elminate materials from his preparation that have proved themselves incompatible with the glucoside, we cannot say he has proved himself a master of his profession or made himself of much benefit to physicians in respect to this class of materials. Even though he may *truly* claim for his preparation that each minim represents completely the medicinal principles of one grain of the crude material, and that every fluid ounce contains the *entire* virtues of one troy ounce of the specified drug, still other than in the slight advantage which would arise from a mere change in form, his pharmaceutical is not superior to the crude drug.

However, some may take issue with me upon this point, and pointing as an example to the fluid extracts now so popular, say—"Are not the soluble principles of the drugs separated from the insoluble and inert materials which accompany them? Are not the insoluble and useless materials, such as lignin, cellulose, starch, etc., eliminated from fluid extracts?" And I will answer, yes. Here I can agree with you, for in this respect you have improved upon nature, but although you have separated these substances, you have added a foreign material that is, in overdoses, *more to be disapproved of than the inert wood and starch,* which at the utmost are merely objected to because they are worthless and tend by their presence to render the administration of the crude drug unhandy, perhaps a little slow in action in consequence of serving as an envelope to the medicinal principles of the drug, and thus preventing them from coming in contact immediately with the juices of the stomach.

But on the other hand, the substance you have replaced them by is a powerful medicine of itself. I know physicians will generally agree with me, for although under certain circumstances it may not prove objectionable, in some cases it is decidedly to be disapproved

*Part of an article in which the glucoside was the substance in hand, not the alcohol.

†From *Eclectic Medical Journal,* 1875.

of. I will warrant that every doctor who reads this article can recall to mind instances where he would have preferred that his patients should have taken two teaspoonfuls of starch rather than one teaspoonful of alcohol. But we shall come to this in its proper place.

(From Eclectic Medical Journal, 1889.)

I will admit in accepting the fact that alcoholic liquid representatives of plants are often desirable, we are being drawn in some directions over broken ground. In my opinion we should differentiate more; the rule of elaboration is usually a good one, but there are many exceptions to the employment of an alcoholic menstruum in plant extraction. The thrusting of a line of alcoholic fluid extracts (followers of the mediæval alcoholic tinctures and essences) upon the profession has been conducive to injury as well as benefit.

Manufacturers and physicians together have broadly accepted in this direction without proper discrimination, and if my opinions are worthy of consideraton, a halt should be called by physicians. . . . The introduction of a line of substances known as fluid extracts, made practically by a universal rule, has led, I believe, to some marked disturbances of this nature. Drugs that cannot properly be extracted with an alcoholic menstruum are often thrust forward as unquestionably represented in an alcoholic form.

Take, for example, the mucilaginous bark of the elm, a drug that should be stripped fresh from the tree, torn into shreds and suspended in cold water in order to produce the soothing, cooling mucilaginous drink that is so refreshing to feverish patients. Its richness depends on its freshness. Each day this infusion should be prepared anew, and the vessel containing it should be kept in a cold situation outside of the sickroom to avoid absorption of foul exhalations.

Is it not illogical to substitute for that mucilage a burning alcoholic "fluid extract" that neither can contain the mucilage of the bark nor replace to the parching patient the grateful drink that may be prepared from fresh elm?

Pass to the other drugs somewhat of this description, comfrey, benne, quince seed, chestnut, and the same rule may be applied. The fresh infusion made with cold water is the best preparation, and every drop of alcohol added is at the expense of the value of the preparation. I do not hesitate to say, in my opinion, a so-called fluid extract or tincture of such a drug is not a desirable preparation. . . .

I rebel against such preparations as fluid extract of Kino and fluid extract of Catechu, and have displeased some patrons by refusing to make them. Other cases can be cited in which such inconsistencies occur, but it is unnecessary, although I might say that in my opinion a decoction of Apocynum is effective where an alcoholic preparation is useless, and that the elaborate formula of the United States Pharmacopœia, 1880, produces a fluid extract of chestnut far inferior to an infusion of chestnut leaves. . . . I freely say that in my opinion this fluid extract hobby has been carried in some directions too far.

The apothecary, the manufacturer, the physician, seem to have crushed themselves together and regardless of compatibles or incompatibles, of consistency or of inconsistencies, have *rushed headlong into an alcoholic craze.* Deserving and commendable in many particulars, objectionable in others, I view fluid extracts as one of the stepping stones to a more perfect pharmacy, which, by a series of evolution, will produce (to be followed by) substances that will surely displace them in the future. They are a crudeness of the present, although they have improved our medicines in some directions by displacing others more crude, or given us more portable preparations. But they have in many instances crowded our shelves with preparations very much inferior to the decoctions and infusions, or even to the crude drugs, that have been displaced.

I do not propose to try to defend myself for the part I have taken in this record, for I do not deny that my zeal in the past has helped to fasten the habit on others, neither do I close my eyes to the fact that many manufacturing pharmacists and their friends may even now decline to accept the situation as I see it.

(From the Proceedings of the Ohio Pharmaceutical Association, 1889.)

The careful apothecary is often confronted with possibilities that the thoughtless may overlook and which an inexperienced druggist may never comprehend. I shall refer now more particularly to the changes that take place in preparations after they are made and while they remain in our hands; changes that may result in a continued variation of drug action from time to time. By reason of this variation the physiological force and therapeutic action of many medicines must surely with all physicians be more or less of an uncertainty.

We do not necessarily have to seek in out-of-the-way places for examples illustrative of the foregoing idea. Indeed, scarcely a day passes that the writer is not called upon to study the matter in one or more of its unrecorded, connected phases, and probably other persons are continually confronted with problems of a like nature.

There are various known causes for these changes in properties of pharmaceutical preparations, familiar examples being the action of light on mixtures containing some compounds of iron, especially phosphate, pyrophosphate and citrate; the slow disorganization of alkaloidal solutions (elixirs perhaps) of slight alkaline reaction; the decomposition and subsequent precipitation of acid solutions containing bismuth salts which often remain transparent for a considerable time and then suddenly fly to pieces, etc., etc.

These familiar examples may be named as preliminary to the consideration of others less known, among which I will mention the action of light on many organic solutions exposed thereto and the questionable power of *alcohol* in maintaining the medicinal force of some organic substances that are soluble in that menstruum. Passing the former (influences of light) I will in this paper confine myself to the latter, which many persons have, I believe, overlooked entirely. Indeed, I have never seen a reference thereto.

By way of a comparison, it may be stated that while it is true that alcohol has the power of suspending acetous fermentation when the alcohol is in *large amount*, it is no less true that in *smaller amount* it is an acceleration of such fermentation, being then a food of the ferment. Thus, vinegar of a quality that is unbearably sour, is practically made by gradually adding whiskey to weak cider, in which case the alcohol reverses its character and becomes a producer of acetic acid instead of a protector against acetification. Pass, however, that phase of the subject, which is well understood, and consider alcohol in quantities so great as to forbid the chance of acetic fermentation, and I am by no means convinced that in other directions it is the uniform preservative that some persons believe it to be. Upon the contrary, it has gradually dawned on my mind, from consideration of alcoholic solutions of many substances, that many bodies readily disintegrate in its presence.

True it is that albuminous substances are coagulated and cannot putrefy when immersed in alcohol, this illustration being typical of its preservative power in that direction and an example that prob-

ably prevents our questioning its power in others, by quieting suspicion. If the brain of a man be placed in a jar and covered with alcohol, it becomes hard, brittle, contracts by loss of water and is indefinitely preserved in its shrunken form; but even here I question if structural changes do not also occur to alter normal conditions. Water of structural life is not water alone. While the form structures of most anatomical specimens are preserved by alcohol by reason of its action on muscle and albumen, I question if their normal interstructural characters remain intact, even though putridity is prevented. Admit that the spirit has prevented putrefaction, has induced albuminous coagulation and acted as a common preservative in this instance in one prominent direction, the question remains unanswered as to its full power of preventing alteration of other substances in other directions.

In this field there may be an element of uncertainty where we have thoughtlessly passed without a question. Most organic bodies are susceptible of alterations that are not explainable as yet by recorded experiments. These changes take place either in the presence or absence of alcohol and may serve as visible illustrations of the subject under consideration, to a few of which I may properly direct your attention.

If certain (most) fresh herbs in a closed jar be impregnated with alcohol by pouring a small amount of alcohol into the jar filled with the herbs, and then agitating until the herbs are thoroughly saturated with the alcohol, it will be found that they lose their green color in a few hours, turning brown. The chlorophyl perishes rapidly in those parts of the plants above the surface of the alcohol, while those beneath its surface sometimes remain green a considerable time, imparting their cholorophyl to the alcohol.

Instead of preserving the chlorophyl in the parts of the plants above the liquid, the alcohol with which they are saturated hastens their decomposition, and a parallel experiment with a like jar of herbs without alcohol shows they will retain their green color long after the specimens saturated with alcohol have become brown or yellowish brown.

This experiment is easily performed and will illustrate the fact that under certain conditions plant constituents dissociate with increased rapidity in the presence of alcohol, which becomes then an accelerator of decomposition, and what is shown by the *seen* may

perhaps indicate what occurs at the same time in other constituents of that plant structure with the unseen. It is more than likely that simultaneous dissociations take place in other plant constituents; indeed, from my present view there is no question on this point.

Make a tincture of the fresh green herb by covering it with alcohol, macerating it a short period and quickly filtering. The tincture will at first be of a rich green. Place it aside. Examination from time to time will show a gradual change to brown and at last the green color may disappear entirely, a red-brown liquid being the result.[1]

It may be argued by some persons that in this instance the destruction of chlorophyl is immaterial since chlorophyl is of no medicinal value. Accepting this view, we may, however, use the striking exhibition of alteration in color thus showing destruction of chlorophyl to permit us to question as to whether at the same time, as already stated, *unseen* dissociations may not be taking place in other directions. We thus may be induced to make comparisons of the results of continued investigations which formulated into a whole become of service.

Pass from fresh plants to those that are dry, for many persons, accepting the Pharmacopœia as infallible, will refuse to accept as medicines other than those made from dry drugs. The precipitates that occur in tinctures and fluid extracts in the presence of an abundance of alcohol illustrate the fact that changes of some description are continually taking place in them.[2]

The sudden decomposition of fluid extract of Geranium maculatum, the complete disintegration of fluid extracts of Stillingia, Iris versicolor, Epigea repens and many others, whereby nearly all of the soluble solid constituents precipitate, indicate that alcohol fails to preserve these liquids from alteration. That these changes are partly of a chemical nature is indicated by the fact that astringency of the liquid then disappears, while the resultant magma is free from astringency with Geranium, Stillingia, Iris and others, and no part

[1] The presence (influence) of water derived from the herb must not be overlooked in this instance. However, the large amount of alcohol present does not act as a preservative.

[2] I do not overlook the phase of the subject contributed by me to the American Pharmaceutical Association in a series of papers some years ago entitled "Precipitates in Fluid Extracts," in which it was shown that natural laws necessarily produce many precipitates that are not dependent on any chemical alteration of plant constituent.

of entire material after decomposition is possessed of its former characteristic properties. Neither the serum that suspends it nor any other menstruum will re-dissolve this precipitate.

The gelatinization of tincture of Kino and Catechu are familiar to all persons and as we consider the subject in its familiar phases the lesson seems to be, interstructural alterations that ordinary amounts of alcohol fail to interrupt changing reactions often in constant process and that these alterations may even continue to the utter destruction of the natural association of the educts originally held by the alcoholic liquid.

We have so far considered only the alterations that *visibly* affect a plant solution and these have been cited as examples because they unmistakably illustrate what may take place in other directions in which the appearance of the liquid is not altered. Reasoning from the facts deduced from a study of the visibly known, it is probable that unseen changes fully as important may be occurring in other directions. Indeed, there is every reason to infer that rearrangements of integral constituents may be continually at work in many alcoholic liquids, the result often being the production of new *soluble* bodies. Owing to the fact that there are no chemical tests for the majority of fluid extracts, these conditions can only be determined by sensible methods. A fluid extract might become dismembered so far as its original organization is concerned, and this fact remain hidden from observation if the resultant products are of the same color and soluble in the same menstruum. Indeed, I am sure that many substances do thus disappear in the presence of even strong alcohol. Of course, the highly developed alkaloids are not likely to undergo much alteration, if any, but many very potent medicinal agents surely disappear entirely. Indian turnip covered with alcohol becomes insipid;[3] alcohol will not preserve its acrid tincture. Tincture of Rhus toxicodendron, intensely poisonous when first made,[4] gradually loses its virulence and at last is practically worthless. Tincture of Anemone pulsatilla loses its anemonin gradually and should never be carried over a season. Even a pure solu-

[3] Alcohol as shown by Prof. Maisch will not dissolve its acrid constituents.

[4] I make several barrels of this tincture each year at the proper season, from fresh herb, because the dry drug is worthless, using strong pressure and alcohol enough to make a very strong product. Each succeeding year I expect to throw into the discard a large amount of this tincture to replace with new crop.

tion of anemonin in official alcohol disintegrates; it cannot be thus preserved. Other examples might be cited to show that energetic soluble principles of plants are not altogether protected from change by alcohol. After considerable attention in this direction I have accepted that we may well study alterations in alcoholic plant preparations with more than usual profit.

To sum up: In my opinion, any cause for uncertainty in the therapeutic power of a pharmaceutical preparation demands the attention and investigation of apothecaries and pharmacists. Alterations that occur in these preparations render the practice of medicine proportionately uncertain. Only by studious attention in the direction indicated in this paper can we hope to determine the extent of such alterations, and these studies with many preparations *must* be made before we can expect to correct the matter. In order to aid the physician, whose skill in diagnosing disease is valueless without uniformly active remedies to meet symptoms of disease expression, we must consider the foregoing subject in connection with others that also render remedies uncertain.

Finally, I must conclude that physicians have much with which to contend from variation of medicinal power of many of the fluids that are made from different qualities of drugs and by different applications of skill in working the same. In some important cases they also have to contend with liquids that are reliable when first made, but become worthless through age, regardless of the skill and care of the operator. In most cases these liquids are dispensed in full faith of their reliability, by reason of the confidence we have in the preservative power of alcohol.

STANDARDS OF DELETED PREPARATIONS.*

By Otto Raubenheimer, Ph. M., Brooklyn, N. Y.

According to the Pure Food and Drug Act, drugs must comply with the standard laid down in the U. S. P. and N. F. The question arises: "How about drugs and especially preparations which have been deleted from the U. S. P. and N. F.?"

The deletions and admissions in the U. S. P. are decided by the Sub-Committee on Scope, mostly composed of physicians, and it is

*Presented at the Fifty-second Annual Meeting of the N. J. Ph. A. at Lake Hopatcong, June, 1922.

perhaps not more than proper that the medical profession shall decide to some extent what their medical material should be. The deletions and admissions in the N. F. are decided by the entire N. F. Committee of fifteen, fourteen of which are pharmacists and one a doctor. In both instances, in the U. S. P. as well as the N. F. the deletions and additions are based on two very important principles, namely *therapeutic activity and pharmaceutic necessity*. Either one, or both factors decide admissions or deletions.

Illustration: The much talked of Elixir Digestivum Compositum N. F. 111 was deleted because the Council on Pharmacy and Chemistry of the American Medical Association insisted that it was a therapeutic incompatibility. To satisfy the medical authorities the N. F. Committee deleted this elixir. The preparation, however, is a pharmaceutic necessity, as it is constantly ordered on prescriptions, and is just as popular today as it was years ago when official.

When the physician orders Elixir Digestivum Compositum he expects to receive the preparation with which he is acquainted, the preparation which was official in the last N. F., the preparation which contains pepsin, pancreatin and diastase. But does the patient get this particular preparation of that particular strength? No sooner this or any other preparation is deleted, many manufacturers or many druggists adopt different formulas which *yield not better, but cheaper preparations*. Money talks, even as to medicine, I am sorry to say. No doubt, the honest, conscientious pharmacist will always dispense the particular preparations which the physician has in mind, the preparations which have a standard either in present or former editions of the U. S. P. or N. F., be they Compound Digestive Elixir, Elixir of Three Phosphates, Iodine Liniment, Fleming's Tincture of Aconite or Magendie's Solution.

It is universally understood that drugs or preparations must comply with the *standards of the latest editions of the U. S. P. and N. F.* It is not so well understood that deleted preparations should also comply with the standards in which they were last official. I would, therefore, respectfully suggest that the New Jersey Pharmaceutical Association should pass a resolution somewhat as follows:

"We recommend that the members of the N. J. Ph. A. adhere to the formulas and standards of the U. S. P. and N. F. also in those cases when a preparation is deleted, so as to produce uniformity in medicine."

MISLEADING ADVERTISEMENTS.*

By Louis Gershenfeld, Ph. M., B. Sc., P. D.

Professor of Bacteriology and Hygiene, Philadelphia College of Pharmacy and Science.

Your attention has been directed, from time to time, to misinformation both in advertising and labeling, and misrepresentation, adulteration and contamination of products sold on the market. The writer feels that considerable good has come out of suggestions which were introduced for the benefit of all concerned by the exposure of this information and he is, therefore, taking the liberty of bringing to the attention of this body additional information along similar lines, which should prove of value.

It is a common practice for many manufacturers, both small and large, but generally the former, to introduce insecticidal preparations and market them also as efficient germicides, inasmuch as it seems to be a better advertising and selling point to have this on the label and in advertising data. You are perhaps well aware that the traffic of insecticides and germicides comes under direct control of the Insecticide and Fungicide Board of the Department of Agriculture. The duty of this board is to promulgate rules and regulations for the protection of manufacturers and the public in general, so that one can be assured that insecticides and germicides placed on the market are actually fit to be employed as the particular manufacturer advises. This particular board apparently has had its hands full and has not perhaps been able to reach all products coming under its direct control.

It may be safely said that the pharmaceutical, chemical and medical professions have been more careful than others, with the result that misleading statements on labels and in advertisements are not as numerous as they have been heretofore. There, however, seems to be one profession, if it may be regarded as such, which has been neglected by those whose duty it is to safeguard the health and welfare of all concerned. The writer refers to the undertaking and embalming profession. It has been his pleasure to closely observe the workings and happenings in this line and was astonished to note the misleading data which circulates in certain corners, which in many instances places an individual in a position that he may jeopard-

*Read at the 1922 Meeting of the Pennsylvania Pharmaceutical Association.

ize his own health as well as the health and welfare of the community wherein he may be found.

It may be interesting to observe, for instance, the labels on embalming fluids which are placed on the market by apparently reputable manufacturers. Embalming fluids are regarded, as they should be, as disinfectants. Is it not to be desired that the manufacturer of embalming fluids shall lay claim to statements which are truthful and not misleading as is expected of manufacturers in other industries? To be specific, may I call your attention to the label of an embalming fluid which is extensively advertised. We find on such label the following:

Directions for Use.

To make one gallon of peroxide fluid of standard strength for arterial embalming, mix the contents of this bottle with seven pints of water. To make one-half gallon of the strongest formaldehyde fluid for drowned, dropsical, cancerous, and such cases, mix the entire contents of this bottle with three pints of water.

It may be possible for such statements to be overlooked by the individual whose knowledge in chemistry and allied sciences is almost nil, but should that be the reason for a nanufacturer to try to put something over on individuals who are not trained along such lines? Does he really expect or think that such misleading statements can really go on forever? It would be interesting to hear how one can make individuals believe that from the same bottle he can so dilute the contents of the latter as to obtain two products of varied and different chemical content. He attempts to persuade one to believe that in the one instance, by adding three pints of water to the contents in the bottle, the end product which he regards as the strongest formaldehydre fluid obtainable is the result, and if we add an additional four pints of water "a peroxide fluid is produced." We can readily see that the chemical knowledge possessed by this manufacturer must be far from extensive, he not knowing the simple incompatibility of peroxide and organic matter.

Eventually this embalming fluid manufacturer may be able to change gold into silver or silver into gold. For centuries and centuries our alchemists have been attempting to do that which appar-

ently the undertaker is doing every day, if we should believe such statement.

Is it possible that our Government authorities or those States that have passed laws in regard to truthful advertising will always ignore or constantly overlook such a misleading statement or ask for an explanation of how the wonderful combination of water with any product can change the same product into an entirely different composition merely upon dilution?

Other than this erroneous statement by what reasoning can one assume that in diluting the contents of the bottle containing embalming fluid with three pints of water, the strongest formaldehyde solution can be obtained? Surely if only one pint of water was used as a diluent or if no water at all was employed, we would have a formaldehyde fluid which would be stronger than that obtained by diluting as directed.

This product was advertised in the June issue of a leading undertaking journal and the following information, directed apparently to the undertakers, was given:

"Many, if not most, fluid manufacturers have been striving for years to put into each bottle of their product the greatest possible amount of disinfecting material, losing sight of every other consideration in what seemed to them to be the vital and important thing—preservation.

"It never seems to have occurred to them that after you have poisoned a germ with chemicals, it is totally unnecessary to hit it over the head with an axe, to cut its throat, blow out its brains, take it down to the river and drown it, and then drag out the body and tie it to the rails and let the Broadway Limited crush it out of all semblance to its former self.

"When you have used a disinfecting chemical powerful enough to destroy a germ you have done all that is necessary. If you want to increase the efficiency of your fluid beyond that, why not give it extra powers of Penetration, so that it can seek out the germs in all the hidden nooks, corners and crannies of the body and get there with enough power to destroy them as well?"

Those of you who have observed the development of modern business methods and advertising have observed that honesty is the first essential which is asked for throughout; truth in advertising is demanded, and such is especially the case when a product is sold

to an individual who does not understand or does not care to understand the intricate details which one must consider in producing a satisfactory combination in embalming fluids, disinfectants, insecticides, etc.

A number of apparently well advertised disinfectants have been found to have very little if any disinfectant value. Such preparations were directed to be used in diluted form for the washing of cadavers, disinfection of bed linens, gloves, instruments and the hands of the embalmer. Another preparation advertised apparently as a disinfectant and insecticide and used as a disinfectant was found to be mainly an insecticide and practically no disinfectant value was found in such product.

There seems to be only three possible avenues for the ratification of remarks passed to any trade by individuals who either unconsciously introduce such remarks or purposely pass them on for the purpose of deceiving every one.

First, an important step has been taken by most reputable newspapers and magazines; that is, to refuse to accept advertisements in which statements have been made that are untruthful, especially when such statements have been brought to the attention of the editors or the publishers of such periodicals. The other is for the manufacturers themselves to associate themselves into one conbined force and attempt by some method or other to introduce a co-ordinating or co-operative method of assisting or aiding the trade or profession and through their particular circles they may take such action as they may be compelled to against their members or non-members who insist upon introducing remarks that are not truthful. The last and the one method which must be finally employed, when all others fail, is to appeal to the consumers regarding such misstatements. It does not require much knowledge or common sense for one to be able to question statements that are so radically wrong. It must not be forgotten that the public after all is indirectly being served by the manufacturer who sells his embalming fluids and other supplies to the undertaker. Empty containers frequently get into the hands of the laymen, some of whom are better versed in the chemical knowledge of such materials than the undertaker or embalmer who actually employs them and it must not be forgotten that very frequently, by such misrepresenta-

tion, an undertaker may be jeopardizing his future career, especially if he will be unable to satisfactorily explain statements made on labels of materials which he employs in the regular routine as required in his profession.

It can readily be observed where misstatements on embalming fluids and disinfectants may lead such manufacturers to be inconsistent in their statements on other products that they may introduce on the market and one therefore is justified in assuming that any manufacturer who misrepresents one article will undoubtedly misrepresent other articles that he may attempt to sell. It would be only proper that the pharmacist and those of us whose duty it is to analyze as well as to determine the efficiency of these products shall inform the consumers as to the value of products available on the market. The only protection that an undertaker or embalmer or any consumer really has is the honesty and truthfulness and high ideals of the reputable manufacturers who are in back of their products. If we could put the buyer on his guard and warn him to select products on which truthful statements are made on labels, our efforts would be repaid in many ways.

It is because of the misdeeds of the few that Government regulations become necessary. Manufacturers and others who honestly and conscientiously attempt at all times to serve the public generally do not and will not fear any legislation that may be promulgated by the State and by our Government for our own benefit.

ABSTRACTED AND REPRINTED ARTICLES

DAKAMBALLI STARCH.*

A sample of this starch was received from Dr. Vevers, of British Guiana, through the Wellcome Bureau of Scientific Research. It is prepared by the Indians of British Guiana from the fruit of the

*Reprinted from *The Analyst.*

tree *Aldina insignis,* and is used by them as a remedy for dysentery, being administered in the form of a mucilage made by boiling the starch in milk or water.

The starch was of pale brown color and, on examination under the microscope, was seen to consist entirely of starch granules varying in mean diameter from 11 to 42 micromillimetres. The small granules were mostly circular, a few being truncated and the larger ones roughly ovate. The hilum was at the broader end, and the concentric rings were well marked. The material was tasteless.

On analysis the following results were obtained:

	Per Cent.
Moisture	19.57
Fat	0.04
Proteins N × 6.25	1.25
Crude fibre	0.10
Matter soluble in alcohol	trace
Matter soluble in cold water	"
Ash	0.21
Starch, by difference	78.83
	100.00

The amount of starch directly estimated by the method of Davis and Daish (*Journal of Agricultural Science,* 1914, 6, 152) was 76.1 per cent.

No alkaloids or cyanogenetic glucosides could be detected in the sample.

It is well known that mucilaginous substances are sometimes effective remedies in colitis and certain forms of diarrhœa and dysentery, and it is not surprising, therefore, that a mucilage made from clean starch such as this should prove equally useful.

J. A. Goodson.

Wellcome Chemical Research Laboratories,
6 King Street, Snow Hill, E. C. 1.

THE LIFE AND WORK OF EMILE BOURQUELOT.*†

Elie-Emile Bourquelot was born at Jandun, in the Ardennes, in 1851, and educated in Charleville. After the disastrous Franco-German war of 1870 he entered the Pharmacie Loret, in Sedan. In the selection of this pharmacy Bourquelot was fortunate, for Loret was a pharmacist who held his profession in high esteem, and made his own galenical preparations with conscientious care. Bourquelot frequently expressed profound gratitude for the instruction received from his chief. "I owe him," he said, "all the instruction I have had in my profession, and I do not in the least regret having under his direction folded packets, used the pestle, and cleaned basins. I profit every day in my own laboratory by his instruction. I owe him above all the love that I preserve for our profession."

During his apprenticeship Bourquelot was attracted to the study of botany, and particularly to field botany, making frequent botanical rambles, and even establishing a small association of six Sedan apprentices with the object of making botanical excursions on their days of leisure. The third year of his apprenticeship was passed at Rheims, and Bourquelot then went to study at the École Supérieure de Pharmacie, in Paris. Here he was awarded the gold medal for practical botany in 1875, the silver medal for chemistry in 1876, the silver medal for physics in 1877, and also the gold medal for students of the third year. In 1875 he entered the Hôpital de la Pitié as "internat," choosing this hospital on account of its proximity to the Botanical Gardens, which allowed of his continuing his studies in natural science. In 1877-1878 he was chief of the laboratory of biological chemistry in the hospital. From 1878 to 1919 he occupied the post of hospital pharmacist in various hospitals. In the École Supérieure de Pharmacie he held in succession the posts of Préparateur des Travaux de Chemie, Préparateur des Cours de Cryptogamie, and Chef des Travaux de Micrographie. In 1880 he graduated as Licencié ès Sciences Naturelles, in 1882 as Pharmacien de 1er Classe, and in 1885 as Docteur ès Sciences Naturelles. In 1897 he was appointed Professeur de Pharmacie Galénique.

*Abstract of "Notice sur la Vie et les Travaux de Emile Bourquelot," by J. Bougalt et H. Hérissev. Société Générale d'Imprimerie et d'Edition, 17 Rue Cassette, Paris, 1921.

†Reprinted from the *Pharm. Journ. and Pharmacist.*

During the period of his greatest activity Bourquelot had a double function to fulfil, *viz.*, that of Professor of Galenical Pharmacy at the École Supèrieure de Pharmacie and that of Pharmacien at the Hôpital Laennec. With characteristic unselfishness he gave up his laboratory at the École de Pharmacie mainly to students who wished to work under his direction, while he himself worked in a small laboratory in the hospital. Establishing himself midway between these two institutions, he reached the hospital every day about 8.30, and left again at 12, returning at 1.30, and leaving at 7. After dinner a light was usually visible in his laboratory or private room from 8 till 10. He thus set an example of assiduous work to all his pupils. Those of the latter who wished to do so were allowed to take part in his work according to their ability. With them he frequently made excursions into the environs of Paris for the purpose of collecting the plants necessary for his researches, and these excursions were made an opportunity for discussing various subjects in natural history.

Bourquelot's lectures were prepared with the greatest care. The necessary information was acquired from the original memoirs, and rested therefore on a sure foundation. The instruction was always kept abreast of the progress in his subject, and no new feature that constituted progress in pharmacy was neglected. He even went so far as to have in the lecture theatre an immunized horse from which the blood necessary for the preparation of sera was drawn.

In his scientific researches Bourquelot had numerous collaborators. Foremost among these were H. Hérissey and M. Bridel, the former working with him for nearly twenty-seven years and the latter for fifteen years. Both of these scientists testify to Bourquelot's conscientiousness, to his marvellous gift of attracting men to scientific work, to the broadness of his views, and to his horror of loudly-proclaimed generalizations based upon an insufficient number of experiments. One of his chief characteristics was the care he took to be sure of his observations.

Although a member of numerous scientific societies, Bourquelot was most intimately connected with the Société de Pharmacie de Paris, of which he was a member for thirty-eight years, and of which he became President in 1898. In 1888 he acted as assistant editor of the *Journal de Pharmacie et de Chimie*, and from 1905 to 1919 as chief editor. This occupied a good deal of his time and handicapped

him in his laboratory work, a disadvantage which was to some extent compensated for by the necessity for his keeping himself posted in all pharmaceutical publications. As editor he exercised a somewhat severe censorship on the articles that he allowed to appear, for all those that were a more or less disguised form of advertisement or that were insufficient from a scientific point of view were rigorously excluded. At the same time he kept his readers well informed of all the chief occurrences of pharmaceutical interest.

In his capacity as Professor of Galenical Pharmacy, Bourquelot was a member of the Permanent Commission of the French Codex, and contributed largely to the preparatory research for the edition of 1908. He was also a delegate to the Congress of Pharmacy in Moscow (1897), in Madrid (1903), Brussels (1910), and The Hague (1913), and to the International Conference in Brussels (1902).

Very characteristic of Bourquelot was his extreme personal modesty. In his private life he was a simple, genial man with a marked aversion to anything approaching a parade of his learning, extensive as that was. In conversation and in discussion with his students he did not by any means confine himself to scientific subjects, but often recounted his experiences in his travels and revived the memory of the many eminent pharmacists with whom he had become acquainted. He remained all his life profoundly devoted to pharmacy, more particularly to scientific pharmacy. He was a steady defender of apprenticeship, which, he was convinced, should be maintained at two years and be precedent to the course of pharmaceutical study. In this he was in agreement with the majority of practical pharmacists and also of such savants as Balard and J. B. Dumas, who repeatedly asserted their belief in the utility of apprenticeship in developing the scientific spirit in young pupils.

The Digestive Ferments.

Bourquelot's first scientific researches dealt with the phenomena of digestion in the cephalopods, and were published in the years 1881-1882. They appear to have had a determining influence on all his subsequent work, for, as he himself says, "I found myself at the outset at grips with the digestive ferments, that is to say, with the soluble, hydrolysing ferments which are the agents of digestion. These researches, in drawing my attention to the part played by soluble ferments in living beings, have, to a certain extent, decided all

my other investigations, which have been extended not only to other hydrolyzing ferments, but also to the principles (sugars, glucosides, etc.) upon which they act, as well as to the study of the soluble oxidizing ferments."

These researches on digestion in the cephalopods, which were utilized by Bourquelot in 1885 as his doctorate thesis, showed that of all the glandular organs appertaining to the digestive system of the cephalopods only two, *viz.,* the liver and the pancreas, secreted a liquid possessing digestive power. The liver furnishes amylase, trypsin and pepsin; the pancreas, diastase. The liver contains glycogen and mucin, like the liver of the higher animals, but it does not contain biliary acids or pigments. Like the pancreas, it contains leucin and tyrosin in considerable quantity; in fact, in the cephalopods, and doubtless in the molluscs generally, there is a concentration of digestivity, whereas in the vertebrates there is division of digestive work which contributes to its greater perfection.

Soluble Ferments.

Partly independently and partly in collaboration with H. Hérissey, Bourquelot discovered a number of new soluble ferments, such as trehalase, which appears to be generally distributed in the fungi, and which converts trehalose into two molecules of glucose; pectosase, which converts pectose into pectin; pectinase, which converts pectin into sugar; seminase, which converts the mannanes and galactanes that compose the horny albumen of seeds into mannose and galactose, etc. He also confirmed the existence of invertin, inulase, maltase, etc., as specific ferments. All these researches contributed to strengthen the opinion that living beings had at their disposal a very large number of these ferments, by which their nourishment was rendered assimilable, and by which the reactions that were carried out in their cells were provoked.

In the course of his experiments on the hydrolyzing ferments of the fungi Bourquelot observed certain phenomena, such as coloration or precipitation in liquids that were originally colorless and clear. This led him to examine them for the oxidizing substances already detected by Schönbein. These proved to be analogous to the soluble hydrolyzing ferments. Those contained in the fungi were shown to be more active than those contained in the phanerogams, and to be capable of oxidizing substances upon which the ferments of the

phanerogams had no action. Bourquelot also showed that there was a difference between those oxidizing ferments or oxidases, properly so called, which exert their action in the presence of oxygen, and those which he called indirect oxidases, which could exert an oxidizing action only in the presence of peroxides, which they were able to decompose, liberating active oxygen.

Investigation of Drugs.

The study of the soluble ferments led Bourquelot to the idea of utilizing them for the purpose of investigating further the constituents present in drugs. This constitutes one of the most original and fertile developments of Bourquelot's work, for it not only led to results of great interest, but furnished chemists with a most valuable means of investigation. Enzymes have the advantage of being more specific in their action than such hydrolyzing agents as the mineral acids, etc. Both sulphuric acid and invertin hydrolyze sucrose, but whereas sulphuric acid hydrolyzes also all the polyoses, the carbohydrates, glucosides, etc., invertin attacks free or combined sucrose only. A positive action by invertin indicates that the sugar liberated is certainly levulose, which was attached either to glucose alone or, by means of glucose, to a larger molecule (gentianose, raffinose, etc.).

Bourquelot directed his efforts chiefly to the biochemical detection of sucrose and glucosides in plants. In order to accomplish this, it was necessary to prevent changes from taking place in the plants after the stage at which their examination was desired. This he effected by throwing the plant little by little into boiling alcohol, and thus stabilizing it. The necessity for such treatment is conspicuously shown by the fungus *Lactarius piperatus*. This, in its natural condition, contains the sugar trehalose; within five hours after collection the trehalose has entirely disappeared and its place been taken by mannite.

Bourquelot examined hundreds of phanerogamous plants by this (the biochemical) method for sucrose, and in no instance did he obtain a negative result. This method is based upon the action of invertin upon the dextrorotatory and non-reducing sucrose, which is transformed into a lævorotatory and reducing mixture of glucose and Levulose. Sucrose, he concluded, was the most widely distributed sugar in plants, and a necessary nutritive princple in all chlorophyll-containing plants, for it was found not only in phanerogams, but also

n a certain number of ferns, horse-tails, etc. On the other hand, fungi contain almost universally trehalose. Bioses are not directly assimilable; to be utilized by the organism they must first be converted into glucose, and this is effected in living beings by a soluble ferment.

Detection of Glucosides.

In a similar manner he utilized emulsin to detect glucosides. In this case the solution that had been employed for the detection of sucrose, and in which this sugar had been completely hydrolyzed, was boiled to destroy the activity of the invertin, cooled, and emulsin added. If a glucoside hydrolyzable by emulsin was present, the reducing power increased and the rotation inclined to the right. Glucosides hydrolyzable by emulsin are always glucose compounds, and are always lævorotatory. In this manner Bourquelot examined 281 species of plants, and in 205 glucosides were found; from 56 they have been actually isolated.

Enzymes in Tinctures.

Bourquelot next directed his attention to the examination of the enzyme action in tinctures, and showed that it was not necessary for the enzyme to be dissolved if the glucoside were in solution and sufficient water were present for the reaction to be completed. Salicin in alcoholic solution was, he found, only partially hydrolyzed, although the enzyme was present in sufficient quantity. On operating upon an alcoholic mixture of glucose and saligenin with emulsin, the glucose was found to combine slowly; it did not, however, combine with the saligenin, but with the ethyl alcohol, forming the ethyl glucoside. This discovery confirmed observations previously made by others, and was followed by the synthesis of a number of other glucosides and also by proof that the enzymes are as specific in their synthesizing action as they are in their hydrolytic.

Bourquelot's researches on the soluble enzymes and the principles upon which they act have found a fertile application in pharmacy. They have led their author to formulate new ideas on the preparation, composition, and preservation of medicaments of vegetable origin, and have thrown light on some of the changes that take place in plants during drying at a low temperature. These plants contain soluble hydrolyzing and oxidizing enzymes; when their vitality is destroyed, their juices mix, and certain principles that they hold in

solution are hydrolyzed or oxidized. If, therefore, the principles actually existing in the plants are to be isolated these enzymes must be rendered inactive, and, since these enzymes retain their activity in alcoholic menstrua, boiling alcohol should be used in the preparation of tinctures from them.

Bourquelot's researches extended over forty years, and were published in upwards of 300 communications to various scientific journals. They have opened up new avenues of investigation, of which scientific workers may be trusted to make full use.

THE SOLUBILITY OF PHENOL IN LIQUID PARAFFIN.*

By Jules Cofman-Nicoresti.

A search has been made through the official Pharmacopœias and other English and foreign pharmaceutical authorities, and, much to the writer's surprise, nowhere was to be found any information as to the solubility of carbolic acid in liquid paraffin.

Martindale's "Extra Pharmacopœia" (Vol 1, 1920, p. 14) gives the solubility of phenol in vaseline as one in twenty, and the United States Dispensatory states that phenol is practically insoluble in cold petroleum-benzine.

To find the approximate solubility of phenol in liquid paraffin, the following experiments were carried out: Solutions from 0.5 per cent. to 10 per cent. were prepared, using Acid. Carbolic. Cryst., B. P., and medicinal liquid paraffin of commerce. The crystals of phenol were rubbed down in a glass mortar, the paraffin added in successive small portions, and the whole transferred to stoppered bottles, which were then placed in hot water to facilitate the solution. When all the phenol had dissolved, the bottles were taken out of the water-bath and kept for twenty-four hours at room-temperature (about 15° C.).

At the end of this time it as observed that: in the bottles containing 0.5 per cent. and 1 per cent. phenol (respectively) the solution was perfectly clear.

The bottle containing 2 per cent. phenol had a few slightly reddish, oily drops of phenol at the bottom of the bottle; while the bottles containing 3 per cent., 4 per cent., 5 per cent., etc., up to 10 per cent. phenol had more of the separated phenol at the bottom of the bot-

*Reprinted from the *Pharm. Jour. and Pharm.*, June, 1922.

tle, the quantity of the separated oily layer being in proportion to the amount of phenol taken.

A further 5 per cent. and 10 per cent. solution was prepared, as described above, but in this case a few grains of menthol was added to the solution. After twenty-four hours standing at 15° C., it was observed that the phenol had crystallized at the bottom of the bottle in fine, white, silky needles.

The conclusions drawn from the above experiments are:

1. The solubility of phenol in liquid paraffin at 15° C. is not above 1 per cent.

2. The quantity of phenol, exceeding 1 per cent., dissolved in liquid paraffin by means of heat will, when cool, separate in a liquid, oily layer, which layer will occupy the lower part of the solution.

Boemingham (*Exper. Cancer.*, December 8, 1921; see *P. J.*, Vol. 108, p. 298) points out the dangers of using liquid paraffin as a substitute for glycerin in phenol solutions. He mentions a case in which a young physician prescribed as ear-drops, for a boy of ten, suffering from ear-ache, liquid phenol in liquid paraffin. A glass dropper was used to administer the drops; the pure phenol collected in the tip of the dropper and was injected in the child's ear, with the result that half the tympanic membrane was destroyed and the external meatus and the auricle very badly corroded.

A similar case came before the law courts in a North town about two years ago. A prescription for ear-drops containing 6.2 per cent. of pure phenol in liquid paraffin had been dispensed by a pharmacist. The patient, after using half of the solution in the bottle (1 ounce bottle), complained of pains in his ears, and suspecting that the prescription had been wrongly dispensed, sent it to an analyst, who found 10.3 per cent. of phenol in the solution.

An action was taken against the chemist for wrongly dispensing the prescription, and in spite of the chemist's defence, the jury, apparently impressed by the analytical evidence, found for the plaintiff, giving heavy damages against the chemist, with the result that the unfortunate pharmacist was sent to the bankruptcy court.

This is another instance which points out clearly that the medical practitioner's knowledge of chemistry and pharmaceutics cannot be trusted, and pharmacists should carefully scrutinize every prescription they take in to dispense.

SCIENTIFIC AND TECHNICAL ABSTRACTS

Adrenalin Tests. L. Zechner and F. Wischo.—The authors give results obtained with various adrenaline tests in which the following oxidizing agents which develop characteristic colorations are used: *Ferric chloride:* The optimum concentrations and quantities are: One drop of a 50 per cent. solution for adrenaline solutions of 1:100, 1 drop of a 5 per cent. solution for solutions of 1:1000, 1 drop of a 0.5 per cent. solution for lower concentrations, with, in each case, an optimum temperature of 10 to 15° C. *Potassium dichromate:* One drop of a 5 per cent. solution added to 1 c.c. of 1:1000 adrenaline solution gives colorations ranging from yellow to orange and red, and finally brown, with turbidity and eventually flakes, whereas no turbidity is produced on adding 1 drop of a 0.5 per cent. solution of potassium permanganate. *Potassium permanganate:* One drop of a 0.1 per cent. solution gives a red coloration and is sensitive in dilutions of 1 in 100,000.—(*Pharm. Monatsh.*, 1921, 2, 141-5; *Chem. Abstr.*, 1922, 16, 787.) Through the *Analyst.*

D. G. H.

Commercial Hydrogen Peroxide Containing Preservatives. P. Poetschke.—A sample of commercial hydrogen peroxide examined contained 11.75 grains of benzoic acid, 0.93 grains of salicylic acid and 1.28 grains of acetanilide per gallon. Results of tests to determine the efficiency of these substances, separately or together, showed that a mixture of benzoic acid and salicylic acid in the proportions mentioned had a decided preservative effect, and that this was not enhanced by the addition of acetanilide. A mixture of quinine sulphate (2.3 grains) and saccharin (1 grain per gallon) also has a preservative action; the saccharin masks the bitter taste of pure hydrogen peroxide, but does not appear to increase the keeping qualities of the peroxide. Without the addition of quinine sulphate, hydrogen peroxide lost 37 per cent. of its available oxygen in four weeks; when quinine sulphate was present the loss was only 14 per cent. in the same period.—(*J. Ind. Eng. Chem.*, 1922, 14, 181-185.) Through the *Analyst.*

W. D. S.

Detection of Veronal in Urine.—According to Zimmerman (*Apoth. Zeit.*, 1921, 35, p. 382) the presence of veronal, luminal, or similar compound in urine may be detected by the following simple method: Two cc. of the urine is mixed with two cc. of ether and shaken; the ether is separated and evaporated on a watch glass. Should veronal be present small rings of minute needle-shaped crystals are formed. A confirmatory test is to disintegrate the rings with a few drops of water and add a drop of a solution of mercuric oxide (1) in nitric acid (2.5) when a turbidity or even a precipitate will be produced.—(Through the *Prescriber.*)

Stain for Leukocytes.—The following solution is recommended by H. B. Cross (*Johns Hopkins Hospital Bulletin,* 32, 1921) for staining leukocytes in exudates:

Distilled water	100 c.c.
Glycerin	20 c.c.
Alcohol (95 per cent.)	20 c.c.
Phenol	2 c.c.

In this dissolve:

Crystal violet	0.06 gram.
Pyronin	0.20 gram.

The stain is ready for use without filtering, and it is stable if protected from sunlight and evaporation. Films are made and allowed to dry in air without heat or other fixation. Staining takes place in five to ten seconds, after which the preparation is washed with distilled water. Any excess of water is mopped up with blotting paper, but the film itself should not be blotted. The cell nuclei are stained violet and the cytoplasm of a uniform delicate lavender, the cell limits being well defined. Bacteria are a deep purple. Erythrocytes appear as pale lavender shadows. Plasma cells and mast cells exhibit a characteristic structure and stain darkly throughout, so that they are easily recognized.

Yohimbine Bark.—The difficulty of distinguishing true yohimbine bark from that of numerous similar and allied species which yield alkaloids closely resembling yohimbine, but have different physiological actions, has led to some contradictory accounts of its

chemical and therapeutic properties. The history and botanical characters of different species of *Pausinystalia* and *Corynanthe* are described, and a review is given of the alkaloids prepared from them. Chemical tests of the bark have proved unsatisfactory, for, although the estimation of the total alkaloids is easy, no method for the quantitative separation of yohimbine and yohimbenine has been found. There is much evidence that yohimbine differs, both chemically and pharmacologically, from quebrachine. Genuine yohimbine bark is that of *P. yohimbe*, K. Sch.; this only differs microscopically from *P. macroceras* in the arrangement of the bast fibres and its characteristic punctiform lumen. The genuine bark occurs in channelled pieces, 4 to 10 mm. thick, having a tinge of red in the brown or grey-brown outer and inner surfaces; the outer surface is longitudinally furrowed, with the edges of the furrows not raised above the general level of the surface, there are narrow transverse cracks at intervals of 1 to 2 cm., and the cork adheres closely. Transverse sections under the microscope show characteristic beaded layers of bast fibres alternating with parenchymatous cells with little or no "twinning." Scrapings from the inner surface, when shaken with dilute sodium hydroxide (10 drops of 1.168 sp. gr. in 30 cc. of water), give a red color varying from wine red to reddish brown; dilute ammonia gives the same color more distinctly, but slowly. The false bark from *P. macroceras* has little or no red tinge, and the edges of the longitudinal furrows are puckered, so that they stand up above the general level; the transverse cracks are very irregular, and the cork exfoliates easily. When the bark is treated with alkali, as above, a brown coloration with only a faint tinge of red results. (*Pharm. J.* 1922, 108, 282-285, 311-314.)—(H. E. C., through the *Analyst.*)

MEDICAL AND PHARMACEUTICAL NOTES

An Incompatible Lanolin Cream.—

℞ Lanolin		℥i.
Zinci Oxidi		ʒii.
Calamine		ʒi.
Aq. Calcis	ad.	℥vi.

This is a cream with more lime-water than the lanolin can absorb. By adding a few grains of saponin to break up the lanolin and sufficient tragacanth to hold it in suspension, and then the powders and the lime-water gradually, a quite presentable and homogeneous cream is obtained. Sometimes the active substance may be soluble in the hot melted basis and separate out on cooling. For example, soft paraffin with 4 per cent. of carbolic acid on cooling shows crystals of carbolic acid. Such an ointment should be stirred until quite cold. When heat is required in preparing an ointment, only what is absolutely necessary should be employed, and always by means of a water bath, and the ointment should be stirred till almost quite cold.

THE MANNA OF MOSES.—Manna, upon which the Jews fed while wandering in the wilderness with Moses, is explained by Dr. Paul Haupt, instructor in Semitic languages at Johns Hopkins University.

Manna was a nutritive lichen like Iceland moss and the reindeer moss, which, in times of great drought and famine, has served as food for a large number of men in the arid steppes of various countries stretching from Algeria to Tartary, Dr. Haupt declares.

The edible lichens, he said, contained not only starchy substances, but in some cases a small quantity of saccharine matter. It was prepared by grinding the lichen-manna in querns or mortars, mixing it with the honey-like drops which exude from the punctured bark of the tamarisk tree, and baking this mixture.—(*Science Service.*)

ETHYL ALCOHOL MADE FROM WOOD.—People do not generally think of wood as a source of alcohol; that is the grain or ethyl alcohol formerly used for beverage purposes and still of use in perfumes, in manufacturing ether and as a solvent. It is quite possible, however, to make grain alcohol from wood waste through a process described by F. W. Kressman, of the Forest Products Laboratory, Madison, Wis.

This process is outlined in *Department of Agriculture Bulletin 983*, "The Manufacture of Ethyl Alcohol From Wood Waste," just issued. The making of ethyl alcohol from such things as straw,

cotton, wood, and many other plant fibres is not at all new, but previously, except in very few instances, it was not possible to use these materials profitably.

There is wasted annually, Government experts estimate, some fifteen to twenty million tons of wood suitable for the manufacture of ethyl alcohol and capable of yielding about fifteen gallons of alcohol to the ton.

The department bulletin which tells about the manufacture of ethyl alcohol from wood waste may be obtained from the United States Department of Agriculture, Washington, D. C.

START CAMPAIGN TO MAKE CRUDE DRUGS CLEANER.—A campaign to eliminate excessive dirt from crude drugs has been started by the Bureau of Chemistry, United States Department of Agriculture, which is charged with the enforcement of the Federal Food and Drugs Act.

An investigation by the bureau shows that the shipping of dirty domestic crude drugs is a rather widespread practice and is due largely to carelessness in gathering. Excessive dirt constitutes adulteration in crude drugs shipped within the jurisdiction of the Federal Food and Drugs Act. In some instances crude drugs were found to contain 20 per cent. or more of dirt.

This practice results not only in an economic loss to the purchaser who usually buys the crude drugs by weight, but obviously lessens the medicinal value of the drug. This condition may be dangerous to the user, restrict the sale of the drug, and consequently lower its marke value. Care on the part of the gatherers would prevent this great excess of dirt. The dealer who ships the crude drugs into interstate commerce is responsible under the Federal Food and Drugs Act and should take steps, say the officials, to correct this condition in order to free himself from liability to prosecution.

Ordinary care such as is exercised in marketing garden products such as carrots, turnips or spinach is usually sufficient. For instance, the washing of the fibrous roots such a goldenseal or unicorn root, before drying would materially improve exiting conditions, in the opinion of the bureau. Inspectors have been directed to give special attention to shipments of crude drugs. Appropriate action under the Federal Food and Drugs Act will be taken in all cases found to be in violation of the law, it is said.

France May Enforce Use of Alcohol (as a Motor Fuel).—France contemplates compelling motorists to use new substitutes for gasoline to reduce her dependency on other countries for mineral oils.

Consul Wesley Frost, at Marseilles, reports to the Department of Commerce that the French government is contemplating the enforced use as motor fuel of a new mixture composed of alcohol, gasoline, cyclohexanol and phenol, partly in order to dispose of great accumulations of alcohol and partly to reduce the country's dependency for mineral oils on the United States, Great Britain and Holland. As a result of extensive experiments a "carburant national," as it is called, has been developed, the practical value of which is claimed to have been proven by tests. The formula is: Gasolin, 900; alcohol at 95°, 100; cyclohexanol, 17.5; phenol, 37.5.

Various interests have been attempting to find an assured market for the alcohol distilled from sugar beets, surplus wines, and vegetable products. The quantities of such alcohol produced in any year fluctuate, and the growers would like to be assured against over-production by an arrangement which would always enable them to convert their surplus into alcohol at remunerative prices. The solution which has been hit upon for disposing of the excess stocks of alcohol and providing a regular market for alcohol in the future is the enforced use of alcohol as an adulterant of gasoline.

The difficulties have hitherto been that the price of the alcohol has been somewhat higher than the price of gasoline so that the resulting mixture would be somewhat more expensive than gasoline. Under the terms of the Beziers Concordat, the French Government would establish a national alcohol office possessing a monopoly of the purchase and sale of alcohol; and this office would produce the carburant national. It would be subsidized by a tax of one franc per hectoliter on all wine marketed in France and of 50 centimes per hectoliter on all cider marketed. It is claimed that the resulting funds could be used to reduce the price of alcohol to such an extent that consumers of the new mixture would not suffer financially. It would thus appear that the wine and cider consumers of France would ultimately pay in the shape of a slightly increased price of wine for a subsidy which would keep the alcohol industry afloat, and would diminish by at least 10 per cent. the French importations of gasoline.

The movement appears to be politically very strong, and there is said to be a possibility that legislation will be enacted which will result in the replacing of gasoline throughout France by a mixture containing 90 per cent. gasoline and 10 per cent. alcohol. The weakest point in the project seems to be the amount of the wine tax, which would be necessary to reduce the price of alcohol to a level with that of gasoline. The contemplated tax might not yield a sum sufficient to provide the subsidy.

SOLID EXTRACTS

An old herbalist formulary states that a necklace of peony seeds will cure epilepsy; that unguentum sympatheticum made of the moss growing on a dead man's skull is a sovereign weapon-salve; that if children three months old are bathed in a decoction of wormwood they will never feel heat or cold; that rue planted among sage protects it from the poison of toads; that grapes will not keep in the same house with quinces.

A combination weed killer and lawn fertilizer of unusual value is furnished in the following mixture: 25 parts each of chloride of potash, and sulphate of ammonium with 40 parts of "superphosphate." The usual amount prescribed for each acre of lawn is about 900 pounds of the mixture.

Injections of an extract of the poison-ivy leaf are now used to protect persons who are sensitive to this powerful toxic agent. This treatment as stated to be practically specific when it is properly indulged in.

The treatment of disease by sunlight was systematically practiced by Hippocrates, the father of medicine, but it was not until 1903 that the first clinic of heliotherapy of surgical tuberculosis was opened by A. Rollier.

That the beautiful, useless butterfly may be the deliverer of mankind from the scourge of tuberculosis is the claim of the French bacteriologist, Metalnikow in a report of his investigations which he has just presented to the Pasteur Institute. His researches have not yet been carried far enough to make any definite conclusion but he declares that he believes himself to be on the track of a very important discovery and has asked the help of other scientists to study along the lines he has begun.

Talc, the soft rock used in making talcum powder, may also be contained in the paper of your magazine, the rubber in your auto tires, and the china on your table.

Among the 180 different kinds of bacteria and other organisms taken

from the bodies of house flies by different investigators are infantile diarrhœa, typhoid fever, anthrax, food poisoning, amœbic dysentery, abscesses, leprosy, tape worms, hook worms, bubonic plague, conjunctivitis, summer complaint, tuberculosis, gonorrhœa, green pus, enteritis, trachoma, erysipelas, gas gangrene, stomach worms, pin worms, ophthalmia.

Though attempts at the isolation of the infective agent in vaccine for smallpox have failed, Dr. W. G. MacCallum of Johns Hopkins University declared to the National Academy of Sciences that it can be separated from most contaminating material if the vaccine is suspended in a fluid of appropriate specific gravity and centrifuged. The infective material in vaccine lymph rises to the top in a fluid of specific gravity 1.16 and sinks to the bottom in any fluid of specific gravity lower than 1.13.

Iron which has been in contact with saline, acidulous and alkaline waters or soil for some length of time sometimes becomes so soft that it can be whittled with a jack-knife.

Blood transfusion first performed in man in 1667 is referred to in Samuel Pepys' diary for November 21 and 30 of that year.

As the evidence piles up, it seems more and more probable that carbontetrachloride, which is commonly used as a clothes cleaner, will prove to be a cheap, agreeable and effective treatment for the hookworm parasite that is destroying health and reducing human efficiency in millions of people in many parts of the world, including many thousands in our Southern States.

THE NINETY-NINTH ANNUAL COMMENCEMENT OF THE PHILADELPHIA COLLEGE OF PHARMACY AND SCIENCE.

The Commencement Exercises were held Wednesday morning, June 7th, at the Academy of Music.

The graduation address was delivered by Dr. Victor C. Vaughan, a member of the National Research Council. (See this Journal, July, 1922.) Dr. Vaughan in his parting message to the graduates impressed them with the need for specializing along selected lines and pointed to them the vast opportunities for real research which true Pharmacy provides. The President of the College, Admiral W. C. Braisted, awarded degrees as follows:

The honorary degree of Master of Pharmacy was conferred upon Mr. Samuel C. Henry, for many years a trustee of the College, and now secretary of the National Association of Retail Drug-

gists; upon Professor J. A. Koch, dean of the Pittsburgh College of Pharmacy, president-elect of the American Pharmaceutical Association; upon Ambrose Hunsberger, recording secretary of the Philadelphia College of Pharmacy and Science, and president of the National Association of Retail Druggists; and upon Dr. Henry H. Rusby, dean of the New York College of Pharmacy, and a noted botanist and explorer, recently returned from explorations in South America, having served as the director of the expedition equipped by the H. K. Mulford Company, to search for new medicinal plants.

Degrees in course were then conferred as follows:

Bachelor of Science in Pharmacy and Chemistry (B. Sc.)

Hollis McCarroll Wible.

Doctor in Pharmacy (P. D.)

Jacob Homer Tyson (P. C. 1917).

Pharmaceutical Chemist (Ph. C.)

Archie Lee Caldwell, Edgar Clarence Knight, Eduardo Palomeque, Charles Clifton Pines, Paul S. Roeder.

Bachelor in Pharmacy (Phar. B.)

Sara Brown, Mildred Frances Carlisle, Anne Goldberg, John Leroy Paul, William R. Woods.

Of the Ph. G. Class, the following were awarded the degree, and received their diplomas:

Graduate in Pharmacy (Ph. G.)

George Dent Adamson, Hossein Amin, John Richmond Baker, Anna Baylin, Lester Marble Bergh, Gerson Bergman, Esther Bernholz, Max Louis Bliss, John Benjamin Blumenfeld, Louis Blumenfield, Nathan Blumenfield, Hyman C. Bogash, Nathan Bremner, Samuel Edward Brian, May Bright, Samuel Cohen, Leslie R. Colestock, Walter Samuel Courson, Edward James Cowman, Francis

Joseph Coyne, Judson Newell Davids, Thomas Leonard Davis, James Joseph Deeney, Raymond Edw. Dersch, Howard Amos Dinstel, Herbert Carlisle Dixon, Austin Paul Dombroski, William Howell Duncan, Martin J. Dwyer, Jr., Herman Elgart, Meyer Elgart, Nathan Finberg, James Vernon Fisher, Abraham Fleisher, Julius Fomalont, Louis Forman, James Gilbert Frazer, Digno Rincon Garcia, Michael Joseph Garman, Herman M. Ginsburg, Carlton Joseph Goodman, Ephraim H. Goodman, Rose Gratz, Rudolph Luther Green, Jacob Greenblatt, Norman Cornelius Greig, Michael Angelo Grieco, John Samuel Griffith, Selig Gross, Frank Wilson Hissong, Oscar Ericson Hysore, Max Jerome Kaliner, Morris Kaplan, John Patrick Kelly, Charles McFarland Kelly, Joseph Francis Kennedy, George Kimmelman, Sterling John Koehler, Jacob Joseph Kotzin, David Kovarsky, William Charles Kramer, Florence S. Kurlancheek, Alexander H. Lackey, Nathaniel J. Levitt, Aaron Lichtin, Harry Lisker, Rebecca Clara Litvackoff, Samuel Solomon London, Ray R. Losh, Jacob Leo Menaker, Attilio Olindo Miceli, George Alvin Miller, Joseph Emerson Miller, Max Leon Miller, Samuel Minzes, Matthew Molitch, Jacob Mones, John Lloyd Moonly, Howard A. Mummaw, Frank Mustaro, Walter Niklewski, Harry Nussbaum, William H. Orland, Isaac W. W. Parsons, Clarence Eugene Phillips, Robert G. B. Phillips, Anna Belle Polakoff, Israel Joseph Possoff, Samuel Raphael Price, Nathan David Promish, Robert Samuel Racier, Estelle Zeror Ralston, Morris Richter, Frederick R. Rogers, Fannie Phyllis Root, Samuel Rose, Joseph Rubin, Joseph Richard Sandler, Samuel Schlichter, Louis Schwartz, Maurice J. Schwartzman, Harry Shapiro, Isadore Sherman, Alvin Clarence Smith, John Wilson Smith, Paul Eugene Smith, Richard Allyn Smith, Louis Steinberg, Emanuel Stephanides, Norris Emrie Stetz, Bryant Da Costa Stroup, Harold Woods Tate, Mrs. Marion Walton, Ralph Isadore Weinstock, Jacob Berman Winer, Jacob Paul Wingert, Benjamin Zebalsky, Joseph Jacob Zonies, Samuel Louis Weinstock.

The following had met all scholastic graduation requirements, but will not receive their diploma until they have reached legal majority:

Thomas Ebert ailey, Hugh Clifton De Hoff, Carl Wilson Gruver, John Forry Hinkle, John Eugene Larkin, Frederick C.

A. Luebert, Nathan Barnett Raich, Victor Louis Rudolph, Louis Schildkraut, Brainerd Herbert Shull, Frank Harold Smoker, Ralph R. Umsted, Louis W. Wasserman, Clarence James Wilson, John Russell Winslow, Charles V. Woodruff.

Those whose diplomas will be released when they present evidence of having met in full the "practical experience requirement" are:

Charles S. Abramson, George Mason Andrews, Eva Boodis, Rose Cann, Benjamin Samuel Cotler, Herbert James Davis, Anna Dershawetz, Louis Herman DeVine, Norman Levi Dietz, Luke Kendig Eberly, William Henry Friedrich, Morris Greengross, George W. Groninger, Charles Edward Harris, Elizabeth Augusta Helm, Louis Kauffman, Noel Sponsler Kohr, Charles Leibowitz, Charles Francis Lisi, Maxwell E. Madres, Philip Simon Moses, Mary Edna Nedzinskas, Morris Louis Pasker, Bertha Passon, Zelda Perez, Courtland Fell Quinby, Nicholas Peter Rossi, William Andrew Shaw, Simon Shute, Elizabeth Acton Test, Jacob Yastrov.

Certificate of Proficiency in Chemistry

The following students having completed the prescribed Technical Chemistry Course of three college years, comprising ten months each, with a roster of five and one-half days a week, were awarded the Certificate of Proficiency in Chemistry:

Clarence Carl Conold, John Russel Fisher, Royce W. McGaughey, Morris Chalfant Matt, Jonas Gilbert Maust, Evan Laurie Rhoads, Harry H. Shull.

Candidates who have completed special courses, and have qualified for certificates:

Certificate in Bacteriology.

Cora Eleanor Allen, Harry Althouse, Russell T. Blackwood, Jr., Donald Charles Butts, Jacob Greenblatt, Joseph Hunt, Morris Kohen, Morris H. Johnston, Vance Howard McVey, Margaret M. Matthews, Louis A. Mestre, John Dickson Oyler, Philip Harrington Polio, Francis Joseph D'Rewal, Evan Laurie Rhoads, Stanley W. Rosenfeld, Porfirio Solorzano.

Certificate in Clinical Chemistry.

Donald Charles Butts, Clarence Carl Conold, Joseph Hunt, John Frederick McGinnis, Louis A. Mestre, John Dickson Oyler, Philip Harrington Polio, Evan Laurie Rhoads.

Certificate in Physiological Assaying.

Marcus Allen Blair, Jr., Carlos Weldon Riblet, Charles Franklin Slotter, Irwin I. Sofronski.

Certificate in Perfumery and Cosmetics.

Evan Laurie Rhoads, Victor L. Rudolph.

Certificate in Advanced Pharmacognosy.

Maurice Bern.

Certificate in Advertising and Salesmanship.

Parker B. Creep, William A. Chamberlin, Helen Hoey, George M. Andrews.

Certificate in Commercial Law.

Edgar P. Swank, Paul William Hughes, W. F. Estlack.

Summary.

Degrees.

Master in Pharmacy (Ph. M.) (Honorary)	4
Bachelor of Science (B. Sc.)	1
Doctor in Pharmacy (P. D.)	1
Pharmaceutical Chemist (Ph. C.)	5
Bachelor in Pharmacy (Phar. B.)	5
Graduate in Pharmacy (Ph. G.)	166
	182

Certificates.

Proficiency in Chemistry	7
Certificate in Bacteriology	17
Certificate in Clinical Chemistry	8
Certificate in Physiologic Assaying	4
Certificate in Perfumery and Cosmetics	2
Certificate in Advanced Pharmacognosy	1
Certificate in Advertising and Salesmanship	4
Certificate in Commercial Law	3
	46

The award of prizes was then announced as follows:

Distinguished.

Gerson Bergman, James Joseph Deeney, Rose Gratz, Rudolph Luther Green, Joseph Rubin.

Meritorious.

Esther Bernholz, Austin Paul Dombrowski, James Gilbert Frazer, Michael Joseph Garman, Carl Wilson Gruver, Jacob Greenblatt, Elizabeth Augusta Helm, Oscar Ericson Hysore, Florence Sylvia Kurlancheek, Rebecca Clara Litvackoff, Frederick Charles August Luebert, Maxwell Emanuel Madres, Attilio Olindo Miceli, Matthew Molitch, Morris Pasker, Nathan David Promish, Robert Samuel Racier, Fannie Phyllis Root, Samuel Schlichter, Louis Schwartz, Frank Harold Smoker, Morris Emrie Stetz, Louis William Wasserman, John Russell Winslow.

The *Procter Prize,* a gold medal and certificate, for the highest general average of the class, was awarded to Joseph Rubin.

The *William B. Webb Memorial Prize,* a gold medal and certificate, offered for the highest general average in the branches of Operative Pharmacy, Analytical Chemistry, and Pharmacognosy, was awarded to Elizabeth Augusta Helm.

The *Remington Memorial Prize,* $20.00, offered by the Estate of Professor Joseph P. Remington, for the highest general average in the examinations in Operative Pharmacy and Dispensing, was awarded to Mrs. Marion Walton.

The *Commercial Pharmacy Prize,* $20.00, offered by Professors E. Fullerton Cook, Robert P. Fischelis, Howard Kirk and C. A. Wesp, for the highest general average in Commercial Pharmacy, was awarded to Robert Samuel Racier.

The *Mahlon N. Kline Pharmacy Prize,* a Troemner Prescription Balance, offered by the Mahlon N. Kline Estate, for the highest general average in Theory and Practice of Pharmacy, was awarded to Attilio Olindo Miceli.

The *Bacteriology Prize,* $25.00, offered by the H. K. Mulford Company, for the highest general average in Bacteriology and Serum Therapy, was awarded to Jacob Greenblatt.

The *James J. Ottinger Prize,* $25.00, offered by Miss Elizabeth H. Ottinger, in memory of her father, James J. Ottinger, Ph. G.,

Class of 1870, for the highest general average, with not less than 90 per cent. in each branch, in Pharmacy, Operative Pharmacy, Chemistry, and Materia Medica, was awarded to Gerson Bergman.

The *Maisch Botany Prize*, $20.00, offered by Joseph Jacobs, Ph. G., Phar. D., Atlanta, Ga., for the best herbarium collection of plants, was awarded to Hossein Amin.

The *Pharmacy Review Prize*, one year's membership in the American Pharmaceutical Association, offered by Ivor Griffith, Ph. M., for the highest general average in Theory and Practice of Pharmacy in the Senior Year, was awarded to Attilio Olindo Miceli.

Prizes for Post-Graduate Courses.

The *Advanced Pharmacy Prize*, ten dollars' worth of books, offered by Professor Charles H. LaWall, for the highest grade in Advanced Pharmacy in either the Ph. C. or the Phar. B. Course, was awarded to Anne Goldberg.

The *J. B. Moore Memorial Prize*, $25.00 in gold, offered by the Rev. J. J. Joyce Moore and Mrs. H. H. Watkins, Jr., in memory of their father, J. B. Moore, to the member of the graduating class presenting the best thesis representing work in the Department of Pharmacy, awarded to Anne Goldberg.

The *Chemical Control Prize*, a year's membership in the American Chemical Society, offered by Charles E. Vanderkleed, for the highest general average in Chemical Control in the Third Year of either the Ph. C. or the Technical Chemistry Course, was awarded to Morris Chalfant Matt.

Prizes Awarded by the Alumni Association.

The *Alumni Gold Medal*, for the highest general average, for all branches in the Senior Year, was awarded to Joseph Rubin.

The *Alumni Prize Certificates*, for the hightest general averages in individual branches in the Senior Year, were awarded as follows: Pharmacy, to Attilio O. Miceli; General Chemistry, to Joseph Rubin; Materia Medica, to Joseph Rubin; Operative Pharmacy, to Marion Walton; Analytical Chemistry, to Elizabeth Augusta Helm; Pharmacognosy, to Hossein Amin; Commercial Pharmacy, to Robert S. Racier.

Prizes Awarded to Under-Graduate Students.

The *Alumni Silver Medal*, offered by the Alumni Association, for the highest average in all branches in the Junior Year, was awarded to Bernard Nichols.

The *Pharmaceutical Arithmetic Prize*, books to the value of $5.00, offered by Ivor Griffith, Ph. M., for the highest general average in Pharmaceutical Arithmetic in the Junior Year, was awarded to Harry Charles Molitz.

NEWS ITEMS AND PERSONAL NOTES

The American Pharmaceutical Manufacturers' Association Elects Officers for 1922-23.—The following officers and directors for the ensuing year were elected: President, Mr. George C. Pratt, of the National Drug Company, Philadelphia, Pa.; first vice-president, Mr. G. A. Kinsel, of The Harvey Company, Saratoga Springs, N. Y.; second vice-president, Mr. George Flint, of the Flint-Eaton Company, Decatur, Ill.; secretary-treasurer, Mr. Ralph R. Patch, of the E. L. Patch Company, Stoneham, Mass.

It was voted to hold the next meeting of the A. P. M. A. at Altamonte Springs, Fla., March 19, 1923.

Prize-Winners at the Annual P. P. A. Meeting.—The $20 gold prize, which is annually awarded for the best paper presented to the previous annual meeting was awarded to George E. Ewe for his paper on "Weights and Measures."

A prize of $5 for the best commercial paper read at this meeting was awarded to Benjamin F. Hoffstein for his paper on "Do You Sell or Keep Spices?"

A similar prize for the most useful paper, was awarded to W. L. Cliffe for his paper on "A Stable Elixir of Iron of Quinine and Strychnine Phosphate."

An absorbing story of the successful search for strange narcotics and new drugs which may prove of invaluable aid in the treatment

of human diseases, and the determining of the botanical sources of both the genuine and spurious forms of certain drugs already partially known, was told by Dr. H. H. Rusby at a recent dinner given to the returned members of the Mulford Biological Exploration, by the H. K. Mulford Company, at the Manufacturers' Club, Philadelphia.

Originally planned only as a personal testimonial to Dr. Rusby and his associates, who had carried out the work of the expedition with so much enthusiasm and in spite of dangers and discouragements, it developed into one of the most significant gatherings of scientists.

In addition to the guests of honor, there were present some fifty men, leaders in medicine, pharmacy, botany, zoology, as well as captains of industry.

P. C. P. Alumni Please Take Notice.—P. C. P. Alumni who are going to attend A. Ph. A. meeting in Cleveland are requested to notify Lewis C. Hopp, PCP 1875, President Northern Alumni P. C. P., 10110 Euclid Avenue, Cleveland, Ohio. This is to be done immediately.

BOOK REVIEWS

A Guide to the Poisonous Plants and Weed Seeds of Canada and the Northern United States. By R. B. Thomson and H. B. Sifton. 169 pages. 14 x 19.5 cm. University of Toronto, 1922.

In the preface the authors say: "The primary reason for this publication is the long-felt need of a text-book to accompany the course on poisonous plants which is given the students of the Ontario Veterinary College. This object has been kept constantly in mind. It has necessitated the preparation of a book at a price within the reach of every student, and yet one that contains in easily available form an up-to-date knowledge of our common poisonous plants, the characteristics by which they may be recognized, the symptoms produced by them and the remedial treatment required."

"To facilitate the determination of the plant responsible in a

given case of poisoning, the book has been divided into four sections. In the first three are included the plants that are mainly responsible for fatalities among animals. These are grouped on the basis of their source in the animal's feed, whether found in hay (Section I), in pasture (Section II), or in concentrated feedstuffs (Section III)." Section IV deals with poisonous plants which are rarely observed to cause death in animals.

The book is written in simple, non-technical language, which makes it very readable. There are a few objectionable features about it, however, which will seriously impair its usefulness. The arrangement of the subject matter into the four sections stated above is not the best form in which to present the subject. It necessitated repeated mention of the same plant inasmuch as many plants are equally dangerous in the pasture or in hay. A short section, such as forms the table of contents, grouping the plants dangerous under the different conditions together with a few words of explanation, is all that is necessary to convey the information. The result of the present arrangement is that *Zygadenus elegans* is described on page 38, and *Z. venenosus* on page 50; *Eupatorium urticæfolium* is given a brief treatment on page 45 under Hay and Fodder and more extended consideration on pages 85-89 under Pasture and Range. The lupines, which are very dangerous on the open range or pasture, are treated only under Hay and Fodder. There are some misconceptions of fact here and there. On page 43, in discussing the subject of lupinosis it is intimated that *Lupinus luteus* is less poisonous than other lupines on account of its smaller alkaloidal content. The yellow lupine is not less toxic in spite of the smaller proportion of alkaloids present. The fact is that this species is one of the few lupines in which the comparatively very toxic sparteine occurs. On page 58 the two alkaloids, delphinine and staphisagrine, are mentioned as the principal toxic constituents of the native larkspurs. Neither of these alkaloids has been found in any of the American species of Delphinium. On page 69 it is stated that "No satisfactory cure has been found for loco disease." The decidedly beneficial results from treating locoed cattle with strychnine and locoed horses with Fowler's solution were published by Dr. C. D. Marsh in 1909. The authors cannot be excused for the bare statement (p. 71), "Barium salts have been suspected as the toxic substance of the Loco Weeds." The barium notion was exploded ten years ago. The figures in the

text are very good; mention should be made, however, of the fact that the illustration on page 87, which purports to be a picture of White Snakeroot (*E. urticæfolium*) is really *Eupatorium purpureum*, or Joe Pye Weed. The constant reference to the use of Potassium permanganate as a remedy is objectionable; that substance has been shown to have very limited applications and probably is worthless where ruminants are concerned.

The book is well indexed and the printing and binding are excellent. A symptoms key to the principal poisonous plants is appended which will be of assistance in making diagnoses of cases of poisoning. There is included a short glossary, which will be useful. The definition of "toxin," however, "A poisonous substance produced in diseased or decaying tissues," is inexact.

JAMES F. COUCH.

AMERICAN RESEARCH CHEMICALS. New Edition.

The compilation of research chemicals which was prepared by Clarence J. West for the Committee on Research Chemicals of the American Chemical Society and the Research Information Service of the National Research Council has just been issued in revised form as Number 35 of the "Reprint and Circular Series" of the National Research Council. The marked advance shown by the American chemical industry during the last few years is evidenced by the surprisingly large number of high grade chemicals listed in this publication as now purchasable from American manufacturers. The so-called "heavy chemicals" have been omitted because there are so many recognized manufacturers and dealers from whom they may be secured. For the same reason practically all inorganic salts are omitted.

Nearly three hundred research chemicals, not included in the first edition, have been added in this revised list. Many additions have also been made to the list of biological stains and indicators, while a list of dyes that have been carefully purified for use as vital stains has been added. The list of hydrogen ion indicators has been very much extended and a chart of these showing the hydrogen ion concentration range added.

It is recognized that the list may have shortcomings and constructive criticisms and additions will be welcomed. Those interested in this booklet may secure a copy from the Research Information Service, National Research Council, Washington, D. C.

NEUE ARZNEIMITTEL UND PHARMAZEUTISCHE SPEZIALITAETEN. Von G. Arends, Apotheker, 6 vermehrte und verbesserte Auflage, neu bearbeitet von Prof. Dr. O. Keller. 578 pp. gebunden $1.60. Julius Springer, Berlin, 1922.

The pharmaceutical and medical profession in the United States can be justly proud upon the New and Non-official Remedies published annually by the American Medical Association. While this volume only contains those remedies approved by the Council of Pharmacy and Chemistry, Germany, can boast of a book which contains all of the new remedies, pharmaceutical specialities, new drugs, biologicals and even substitutes, or as the referee prefers to call these "parallel preparations."

The first volume of "New Remedies and Pharmaceutical Specialties" was compiled by Georg Arends, a well-known apothecary and pharmaceutical writer in 1903. Since the fifth edition in 1919, Prof. Dr. O. Keller, of the University of Jena, has edited the book. The new edition has been enlarged to 578 pages and is compiled in the usual very thorough German style. Six pages are devoted to Father Kneipp remedies, four pages to Radium and three pages to Digitalis preparations. The digitalis principles are fully enumerated *i. e.,* Digalen, Digitalein, Digitalin Schmiedeberg, Digitalinum pur. amorph., gallicum and Homolle, Digitaline chloroformique, Digitalinum pur. pulv. germanic, Digitalinum cryst., Digitalinum verum, Digitonin Kiliani and Schmiedeberg, Digitoxin cryst. Merck, Digitoxin cryst. comprim., Digitoxin solubile and Gitalin. This enumeration may also well serve as a good example of the confusing similarity of pharmaceutical nomenclature, which may lead to serious errors, in fact, loss of life.

The paper, printing and binding are in first-class style, as can be expected from the well-known publishers, Julius Springer, in Berlin, who are famous for their pharmaceutical publications. Arends-Keller's Neue Arzneimittel will be of great help not only to editors, research workers and pharmaceutical chemists, but also to the prac-

tical pharmacists behind the prescription counter. It is to be hoped that the book will also become better known in pharmaceutical circles in the United States.

OTTO RAUBENHEIMER, Ph. M.

DAS OPIUM. Seine Kultur und Verwertung im Handel. Von Axel Jermstad, Ph. D. Duodecimo, 208 pp. Vienna and Leipzig, A. Hartleben's Verlag.

The well-known publishers issue a chemical-technical library in which the present book is volume 368. Prof. Dr. Heinrich Zörnig, director of the pharmaceutical institute of the University of Basel, was good enough to write an introduction to this book. Jermstad was one of his students and prepared his thesis for his doctorate under Zörnig's direction.

How well this monograph on opium is written can be seen by the outline of its contents: I, Historical; II, Geography; III, Cultivation of Opium in Asia Minor, Macedonia, Persia, India, Egypt and China; IV, Experimental Cultivation of Opium in Algeria, Australia, Bulgaria, Denmark, Germany, England, France, Greece, Holland, Italy, Japan, Java, Norway, Austria, Poland, Russia, Sweden, Switzerland, Serbia, Spain, South Africa, Turkestan, Hungary and United States.

The entire monograph is prepared in a very thorough manner, which reflects with honor the excellent training which Dr. Jermstad has received. The author has consulted the pharmaceutical literature of the world, including the AMERICAN JOURNAL OF PHARMACY. We can highly recommend this book.

OTTO RAUBENHEIMER, Ph. M.

THE AMERICAN
JOURNAL OF PHARMACY

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EDITORIAL

IS CHEMISTRY DOOMED?

Many of the thousands of workers who are assiduously engaged amidst beakers and flasks, balances and burettes in chasing the very elusive alkaloids and the less elusive heavy metals, are not aware of the trend that threatens the individuality of their science. Coming events may cast their shadows before, but such shadows are seen by but few and sometimes by no one. Those who proclaim the coming storm are almost always regarded as Cassandras. For a goodly number of years, and of late with increasing vividness, it has seemed likely that chemistry will be absorbed into physics, as astronomy has been. An evolutionary movement may remain long unappreciated, and its direction and effects misunderstood. Concerning chemistry, the camel's nose was inserted in the tent about the middle of the last century when "chemical physics" began to appear as a section in text-books. The pioneers were essentially Pfeffer, Dutrochet and Graham. The first-named, a botanist, discovered the elementary facts about the transudation of different solutions through membranes, the second introduced the terms "endosmose" and "exosmose," and the last-named gave us the word "dialysis" and many additional facts concerning osmotic phenomena. Since the days of these investigators, an immense amount of data has been accumulated, notably in the fields of colloid chemistry and ionization, and the present-day text-books have a very different appearance from those in use fifty years ago. In the earlier ones an algebraic formula was scarcely, if ever, seen. A few examples in stoichiometry, employing simple proportion, made up the methematical allusions. Today higher algebra and calculus are much in evidence.

The old term "chemical physics" is no longer used. The data are all grouped as "physical chemistry," but the change by which chemistry became the noun instead of the qualifying adjective does not mark a dominance of that science, for as matter of fact, the great bulk of the data in physical chemistry is physical not chemical. There seems to be a possibility that before many years teaching chemistry will be only a department of physics. Even now it is often included in a "Department of Physical Sciences" in contrast with a "Department of Natural Sciences," which include Biology, Geology and some kindred topics.

The crisis is indicated by an article in the current number of *Scientia,* the international journal of synthetic science (published in Italy), entitled "The Steps of the Absorption of Chemistry by Physics," by Marcel Boll, of Paris. After an interesting review of some of the developments of physical chemistry, not including any reference to colloid phenomena, the author proceeds, as follows: "Among other philosophic influences, the new theories do not fail to modify the traditional ideas as to the domain of chemistry and its place among the other sciences. . . . It is often said that chemistry should occupy itself with setting forth the properties of substances, but a collection of facts, however numerous, does not constitute a science; what is termed 'descriptive chemistry' is merely a preparation for the science. Until late years, chemical action was defined as that which profoundly alters the properties of substances, but this definition is superficial and out-of-date. It makes the nature of phenomena subject to vague impressions of the senses, and neglects the reversible reactions, the theoretic significance of which cannot be overestimated. The profound transformations under the influence of radio-activity cannot be separated from physics. The distinction between chemical and physical phenomena is indefinite, because changes of state, solution and chemical reactions present close analogies, and form a quite homogeneous group, obeying common laws, which, for the most part, are dependent on thermodynamic principles."

The absorption is, however, according to our author, to go on, and chemistry will have its revenge by seeing the absorption of physics by mathematics, since Euclidian geometry and Newtonian mechanics are only approximations, sufficient for practical purposes. "The reduction of chemistry to physics is thus but one of the episodes of

present-day work, which leads irrevocably to the interpenetration of the sciences, fragmentary when first developed and necessarily confined within artificial limits."

In the analytical laboratory the invasion of physics has been for some years quite evident. Apparatus substantially physical, such as refractometers, polarimeters, electrolytic measuring instruments, microscopes with many accessories are now part of the necessary equipment of the ordinary commercial installation. In earlier days, the student who left college to take up chemical work could afford to forget all about logarithms, but the importance of hydrogen-ion concentration has brought back such problems into the midst of the beakers and balances. The probability is that before many years the chemistry, as profession for the solution of problems in industries, sanitation, toxicology and such subjects, will be differentiated markedly from the research work, especially in biology and physical chemistry, and the workers in each field will pursue their occupations with more or less independent spirit.

H. L.

SELECTED EDITORIAL

NAMING THE BRAIN-CHILD.

From Science Service.

When a man makes a new invention or unearths a new medicine his work is not done. He should invent a new name for it. Here he is apt to fail, for, being more of a mechanic than a philologist, he turns over the job to the Greek professor who manufactures one out of old roots. So it happens that many a handy little pocket tool or a potent little pill is handicapped by a name that wraps three times around the tongue. But the people refuse to stand for it.

Consider what a Babel-like botch has been made of the job of naming the new art of photographing action. Rival inventors, rival word-wrights, and rival systems of Greek transliteration precipitated a war of words in which the chief belligerents were animatograph, animatoscope, biograph, bioscope, chronophotography, cinema, cinematograph, cinematoscope, cineograph, cineo-

scope, electrograph, electroscope, kinema, kinemacolor, kinematograph, kinematoscope, kineograph, kineoscope, kinetescope, motion pictures, moving pictures, photo plays, tachyscope, veriscope, vitagraph, vitascope, zootrope, zoogyrograph, zoogyroscope and zoopraxiscope.

But the people—they call it "the movies." It is not a great name, but it is better than some at least of those listed above.

If, instead of trying to load the new machine with a name implying that it had been invented in Athens or Rome, its godfathers had given it a respectable, convenient name of one or two syllables like "kodak," "volt," "velox," or "viscose" much of this confusion might have been saved. Think how many millions of dollars, years of time, barrels of ink and cubic miles of hot air would have been saved if "electricity" had been named in one syllable instead of five. We might even now cut it down to "el" except that by popular vote the six syllables of "elevated railroad" has been reduced to that handy term. So, too, the people have found a way to reduce "radiotelephony" to a single mouthful, "radio," and the druggist round the corner finds it much easier to say cinchophen in preference to phenyl cinchoninic acid.

The lesson of it is that if the father of a new invention or a new drug does not want to have his child called by a nickname let him give it a short and snappy name on the start.

E. E. S.

ORIGINAL PAPERS

ANATOMICAL AND CHEMICAL STUDIES OF THE SAND SPUR (CENCHRUS TRIBULOIDES L.).*

By Heber W. Youngken and Charles H. La Wall.
Philadelphia College of Pharmacy and Science.

The early history of *Cenchrus tribuloides*, commonly known as Sand Spur or Sand Bur, and also known by the synonyms of Bur Grass or Hedgehog Grass, the spiny burs of which have caused painful wounds in man and the lower animals, appears to be somewhat obscure. That this plant was known to the pre-Linnean botanists is evidenced by the statements of representative authors of that period. Thus Moris [1] figures a plant which is identical with *Cenchrus tribuloides L.* and describes it in the phrase: *"Gramen echinatum, spicatum locuster crassioribus tribuloidibus Virginianum."*

Plukenet [2] in his "Phytographia" lists the plant under the title of *"Gramen tribuloides spicatum maximum virginianum."*

To Linnæus,[3] however, belongs the credit of naming the plant as it is known to most botanists of today. In his "Species Plantarum" of 1753 he listed it under the *"Polygamia Monœcia"* and described it as *"Cenchrus glumis femeneis globosis muricate spinosis hirsutis,"* and mentioned its habitat as Virginia near the sea.

Muhlenberg,[4] a clergyman and early American botanist, lists it in his "Catalogue of Plants of Lancaster, Pa., and Vicinity" under Class III, Triandria Monogynia, and states that it is a wooly, spiked annual with one subrotund seed and having a two-valved calyx, two-valved corolla and a two-flowered involucre. He appears to be the first to name it Sand Spur, Hedgehog Grass or Sand Bur.

In 1814 Frederick Pursh,[5] in "Flora Americæ Septentrionalis," gave its distribution as near the seashore from New Jersey to Florida and described it as *"Cenchrus spica spiculis alternis, glumis femineis globosis muricato spinosis hirsutis."*

In 1824, Torrey,[6] in "Flora of the Northern and Middle Sections of the United States," described it as follows: "Culm a foot to one and a half feet high, compressed, smooth. Leaves linear, lanceolate, conduplicate, a little roughened above. Sheaths dilated open. Racemes ten to fourteen flowered; rachis angular, hairy. Involucrum

*Read before the 1922 Meeting of the Pennsylvania Pharmaceutical Association.

split on one side, hairy, including two spikelets, each one to two flowered." He stated its distribution to be on the sea coast and near the mouths of rivers.

It appears that few lay citizens of the United States made the acquaintance of Sand Spurs until the battle of Palo Alto, during

Fig. 1. *Cenchrus tribuloides* L. x 1/3.

the Mexican War, when, according to Meehan,[7] they were quite as annoying to our soldiers as the bullets of the Mexicans. The bur-like fruits attached themselves to the soldiers' clothing and in this way the plant became widely distributed after the Mexican War.

Chapman,[8] in his "Flora of the Southern States," published in 1860, gives the synonym of Cock-spur for Cenchrus and describes *Cenchrus tribuloides* as follows: "Involucres whitish, ten to fifteen in a spike, wedge-shaped at the base, armed above with stout, com-

pressed, broadly subulate, erect or spreading spines; bristles none; spikelets mostly in pairs. Sands along the coast, Florida and northward. July-October. Annual, with prostrate culms, one to two feet long. Leaves linear. Spikes one to two feet long."

Apparently no work was published on the histology of this plant until Gayle,[9] in 1892, briefly described and figured the lower portions of the spines of the fruit. He states that the spines are barbed, that each barb has within it a cavity terminating in the direction of the point, in a narrow tube and to be filled with a substance which has a light purple color. He adds that in all probability this substance is of a highly irritating nature and may be assumed to be the direct cause of the inflammation of the wound. He figures and describes large air spaces in the spines.

In Gray's "New Manual of Botany," revised by Robinson and Fernald,[10] the synonyms Sandbur and Bur Grass are given the genus Cenchrus and the following description of *Cenchrus tribuloides* L.: "Culms more robust (than *C. carolinianus*), often extensively branching or trailing, three to nine dm. long; sheaths loose, usually hirsute along the margins, ligule conspicuously ciliate; blades more or less involute; racemes usually included at the base; involucres twelve to fourteen mm. thick, densely long pubescent; the stout spines spreading or ascending. Sands along the coast, New Jersey and southward."

Britton and Brown,[11] in second edition of their "Illustrated Flora of the Northern United States, Canada and the British Possessions," published in 1913, state that the plant is found in sand along the coast from Long Island and New Jersey to Florida and Mississippi. The same authors briefly describe the plant and give as its synonyms, Bear-Grass, Bur-Grass, Sand-spur and Sand-bur.

In 1920, Hitchcock and Chase,[12] in their "Revision of the North American Grasses," carefully described and figured the external features of the plant and its fruit. They consider the inflorescence as a contracted panicle with short, fascicled branches, these disarticulating from the main axis and all but a few being sterile. According to these authors the body of the bur represents the cup-shaped or globose part which is found to be formed by the coalesced part of the branchlets from which the free ends extend. The lobes are considered as the free ends of the innermost ring of branchlets which form the body. The same authors give the distribution of the plant as in loose sands of the coast from Staten Island, N. Y., to

Florida and Louisiana, on the Atlantic Coast of Costa Rica, in the West Indies and on the coast of Brazil.

The writers of this paper became interested in the subject while working on a sample of Sand Spurs with the purpose of ascertaining whether any constituent of the hairs or barbs was responsible for the inflammation which in many instances follows wounds induced by their spines.

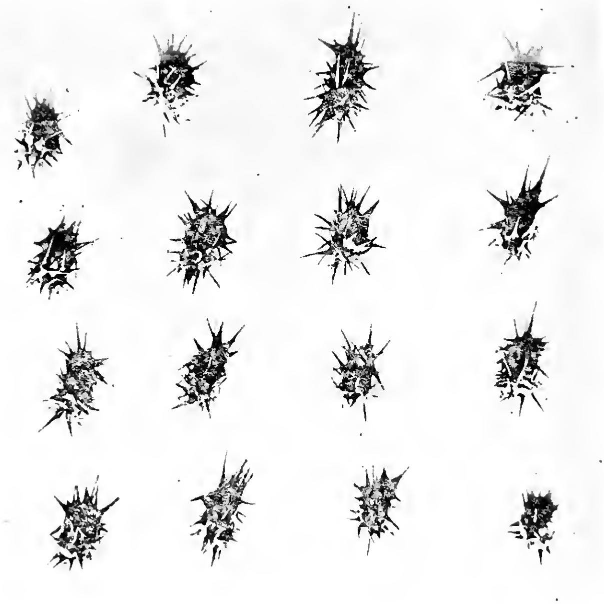


Fig. 2. Burs of *Cenchrus tribuloides* L. (nat. size).

The materials used were abundant dried burs (obtained from Florida) in varying stages of maturity as well as herbarium sheets of *Cenchrus tribuloides* from the Martindale and College herbaria. The anatomical and micro-chemic portions of the work were carried out by Dr. Youngken, while Dr. La Wall investigated the chemistry of the mature burs with contained fruits. Observations on the growth habits of this plant were made by both the writers along the coast of New Jersey.

Description of Cenchrus tribuloides L.

Cenchrus tribuloides Linnæus (Fig. 1), commonly known as Sand Spur, Sand Bur, Coast or Hedge-Hog Grass, is an annual weed

belonging to the Grass family and found growing in sand dunes near the coast and along the beach from Long Island, N. Y., to Florida, Louisiana and Texas, on the Atlantic coast of Costa Rica, along the coast of the West Indies and of Brazil. From a subterranean fibrous root system arise several culms, which soon branch and grow out in radiate fashion, attaining a length of up to 60 cm. Each of these is decumbent and takes root at its nodes, from whence also arise several ascending branches that may attain a length of 25 to 31 cm. The leaves are alternate, exstipulate, each exhibiting an overlapping sheath, a lamina and a ligule. The sheath is keeled, pubescent along the margin and at its summit and exhibits a dense tuft of hairs. The blade is flat and linear-lanceolate, scabrous on upper surface, with more or less involute margin, up to 18 cm. in length and up to 7 mm. in breadth at the base.

The inflorescence consists of a raceme or spikelets borne along a zigzag rachis and enclosed singly or in pairs within a spiny, subglobular, pubescent involucre, 12 to 14 mm. thick, which, upon maturity, forms a deciduous, hard, rigid bur (Fig. 2), with stout, broadly subulate barbed spines. Each burlike involucre contains one or two awnless spikelets. When these are examined separately under a dissecting lens they show from without inward the following parts: (1) a hyaline scale, (2) two membranous scales, (3) a palet surrounding a staminate flower, (4) a papery scale subtending (5) palet of a perfect flower, and (6) a perfect flower with a unilocular, acuminate-ended pistil that terminates in two short plumose styles. The fruit is a pyriform caryopsis (Fig. 8), terminating in two short styles and containing an albuminous seed. One to two of these fruits occur free within the scales of the spikelet or spikelets of each spiny bur. When mature the burs separate readily from the rachis and fall to the ground. They are well adapted for distribution through the agency of man and fur-bearing animals because of their sharp, rigid and barbed spines which stick to the clothing or fur coat. Frequently the spines penetrate the skin and flesh of exposed surfaces, particularly the feet of non-vigilant bathers and cause distressing pain and inflammation. They are difficult to extricate when forced into the skin even half of their length. This is due to the presence of sharp, retrorse barbs extending backward from the tip half the length of the spine. In attempting to remove the spine the flesh is torn by the barbs and the wound made larger.

Histology of the Burs.

The burs of *Cenchrus tribuloides L.* possess a somewhat rounded polygonal outline, when observed in transverse sections, and exhibit numerous outgrowths in the form of long, flattened, attenuated spines (Fig. 2). They, therefore, present for examination interspinal regions and spines. Excluding the hairs, the interspinal regions of

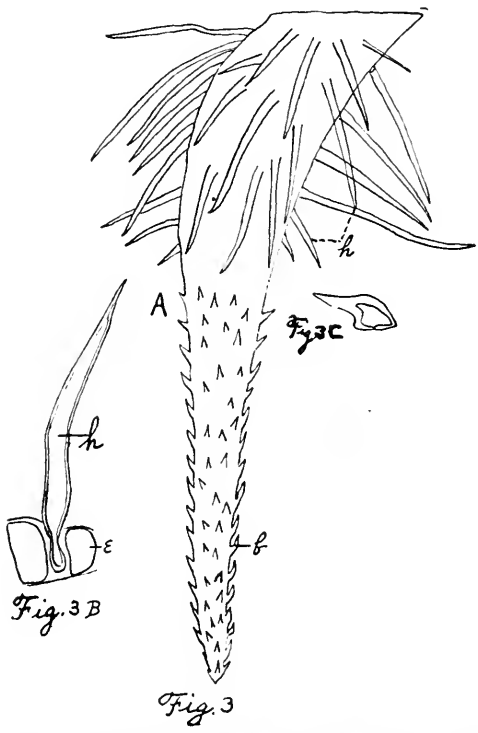


Fig. 3. *A.* Spine of *Cenchrus tribuloides* L. showing barbs (b) below and unicellular hairs (h) above. *B.* Portion of epidermis of spine showing insertion of hair (h) between epidermal cells (e). *C.* Barb enlarged.

burs, containing good fruits, averaged 245 μ in diameter. They exhibit externally a colorless epidermis composed of a layer of clear, vertically elongated, epidermal cells with a thick cuticle and granular contents. Here and there between many cells of the epidermis are inserted the bases of unicellular non-glandular hairs. These hairs tend to show all transitions of development and while for the greater part are inserted far down, on the level with the

inner walls of the epidermal cells, nevertheless, may be found at varying levels. The tendency for the insertion to be higher is strikingly seen as the bases of spines are approached. There hairs may attain a length of 800 μ or more. They are usually slightly curved, tend to become more or less constricted near the base and terminate in sharp, straight or slightly curved ends. Each hair possesses a cellulose wall with a colorless outer cuticle and contains protoplasmic contents or air depending upon its age.

On the inner surface of the interspinal regions is to be noted a layer of clear, colorless, inner epidermal cells, possessing hairs somewhat similar to those of the outer epidermis but averagely shorter.

Between outer and inner epidermis is to be observed a broad mesocarp composed for the greater part of sclerenchyma fibers with thick, lignified walls. Coursing through this region are isolated, closed, collateral bundles.

The spines originate early in the development of the bur as outgrowths of its tissues. In their young condition they are often purplish-red or bluish, but gradually lose this color and become yellowish-brown.

They are for the most part flattened, conical in shape, with sharp attenuated distal ends. They are clothed with hairs (Fig. 3h) in their proximate third and exhibit sharp, recurved barbs (Fig. 3b) for the remainder of their length.

Transverse sections made progressively through the spines at varying distances from base toward the summit show an irregularly elliptical outline until the tip region is reached, where the outline is circular. (See Fig. 4.)

Each spine shows an outer epidermis investing a core of sclerenchyma fibers pervaded by fibro-vascular strands from the involucral-bur. The epidermis consists of long cells and short cells. As observed in transverse section, the long cells are rectangular, with thickened outer cuticle; in surface view they are rather narrow, elongated, pitted elements with wavy, vertical walls. Between the long cells at their ends are the short cells. They are found either singly as silica cells with a rounded lumen and silica content, or else in pairs known as twin cells, one of these cells being larger and occasionally clasping the other cell. The epidermal cells are largest at the base of the spine and become gradually smaller toward the tip. In about the lower two-thirds of the spine are to be noted sharp-pointed, re-

curved barbs (Fig. 3b), while in the upper portion unicellular, non-glandular, sharp-pointed hairs are visible (Fig. 3h).

The barbs readily break at their tips when pressure is applied to them.

The purplish-red to blue color of parts of the younger spines is found to be due to anthocyanins present in the cell sap of certain epidermal cells, sclerenchyma fibers and barbs.

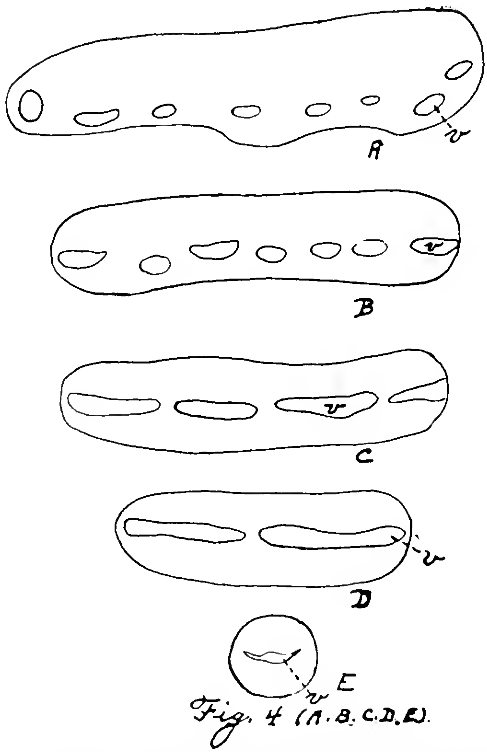


Fig. 4 (A. B. C. D. E.). Diagrams of cross-sections through several successive regions of the spines of *Cenchrus tribuloides* L. showing the outline of spines at successive levels as well as the gradual union of the vascular strands (v) in passing from base to tip.

Surface and longitudinal sections of younger spines showing purple and blue-colored cell sap in these elements were examined microchemically. The results were as follows: When thin sections were placed in a 10 per cent. alcoholic solution of ferric chloride the originally purple or blue cell sap became red in about a minute. When to this concentrated hydrochloric acid was added the color

disappeared in a short time. When other similar sections with cell sap originally purple to blue were mounted in a 1:5 solution of silver nitrate and gently warmed, the purple and blue contents became black. These tests would tend to show that formates may be present in certain cells of the epidermis, as well as in a number of sclerenchyma fibers and barbs of younger spines.

Surface and longitudinal sections of mature spines show the elements to be entirely devoid of the purple and blue cell sap contents noted in the case of younger spines.

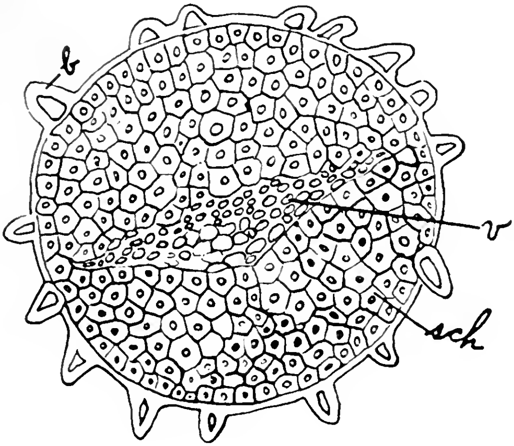


Fig. 5

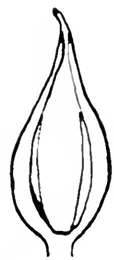


Fig. 6

Fig. 5. Transverse section through the spine of *Cenchrus tribuloides* L. near its termination showing barbs (b), sclerenchyma fibers (sch) and vascular tissue (v), (greatly magnified).

Fig. 6. Fruit of *Cenchrus tribuloides* L. invested by palet.

The non-glandular hairs are not outgrowths of epidermal cells, but are inserted, as in the case of those of the intraspinal region of the burs, between the cells of the epidermis.

The sclerenchyma fibers (Fig. 5sch) occupy most of the area beneath the epidermis. They are thick walled, porous, strongly lignified and taper-ended elements with narrow lumina, polygonal to rounded-polygonal in transverse section. No distinct intercellular cavities such as Gayle [13] pictures and describes have been found between them. It is possible that the cavities noted by Gayle were breaks in the sections he studied due to the falling out of areas of

fibrovascular or sclerenchyma cells during the technique of sectioning.

Fibrovascular tissue (Fig. 5v) is found coursing through the sclerenchyma zone of the spine.

A series of sections (Fig. 4 A, B, C, D, E) made through varying levels of the spine show eight bundles (v) at the base. These are found to diminish in number toward the tip, due to the union of bundle strands, until only one fibrovascular strand is evident in the extreme distal region. Each fibrovascular bundle contains annular, spiral and scalariform tracheids and sieve tubes.

When burs are placed in weak alkaline solution for several hours and their spines subsequently examined microscopically, the epidermis appears broken and the sharp-pointed sclerenchyma fibers more or less detached. The latter are readily separated upon pressure. From the foregoing observations it appears logical to assume that the pain and inflammation which results after humans and lower animals are wounded by the spines of this bur are, in the case of mature spines, caused alike by the stimulation of nerve endings by the entire barbed spine and by its sharp sclerenchyma fibers, which may be loosened and detached in the flesh fluids. The sharp recurved barbs lacerate the flesh when the spine is removed, and, lowering the resistance of the tissues, subject the wound to invasion by pyogenic and other bacteria. This undoubtedly accounts for the delayed inflammation that results after removing the spine from the wound. In the case of injury from younger spines, the fluid containing what appears to be formates, which occurs in the lumen of barbs, may be injected into the wound, upon fracture of the sharp, brittle tips of these structures, and so intensify the pain.

Histology of the Scales and Palet.

The hyaline scale shows three strong nerves and is barbed with short, sharp-pointed, unicellular hairs at the summit and over the outer epidermis. Some of these hairs are hooked at their ends. Its epidermis consists of long cells, short cells, stomata and twin cells. The long cells are elongated longitudinally and have thin, indistinctly porous, wavy walls. Some of the short cells give rise to short unicellular, needle-pointed barbs. Others contain silica.

The membranous scales are thicker in texture than the hyaline scale, are three-nerved, and barbed at the summit and over the outer surface with hairs similar to those found on the hyaline scale.

The side walls of their long cells are thicker, and more closely wavy than those of the hyaline scale and the lumina are narrower.

The palet is ovate-lanceolate in shape and shows a keel with two prominent nerves. Its epidermal cells (Fig. 7) and hairs are somewhat similar to those of the membranous scales and are mainly distributed on the outer epidermis near the summit, and along the upper portion of the keel. The hairs are similar to those found on the other scales and measure up to 42 μ in length.

Histology of Fruit.

The fruit of *Cenchrus tribuloides* (Fig. 8) consists of pericarp, spermoderm, endosperm and embryo regions. As in the case of fruits of other grasses and cereals, the pericarp and seed coat are firmly united.

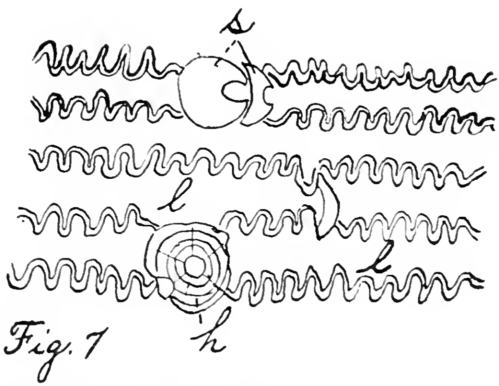
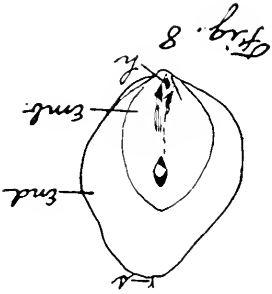


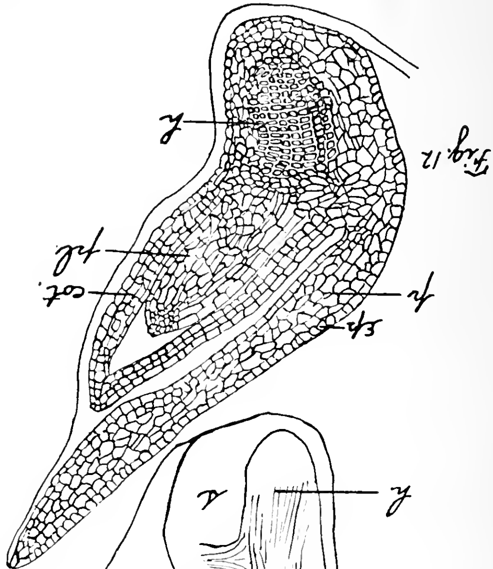
Fig. 7. Surface view of epidermis of palet showing long cells (l); twin cells (s) and base of hair (h), (highly magnified).

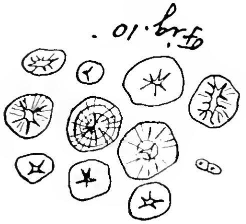
The pericarp comprises the following regions: (1) A layer of outer, colorless cells with beaded side and end walls that are generally elongated longitudinally and arranged end to end in rows, the double side walls being about 4.2 μ thick. No hairs have been found on this layer; (2) a layer of short, irregular-shaped, beaded-walled cells, and (3) a layer of loosely arranged tube cells of vermiform shape.

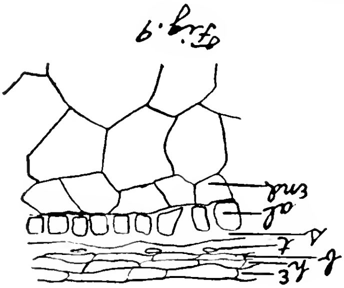
The spermoderm consists of a layer of elongated pale brown cells.

The endosperm shows an outer layer of aleurone cells (Fig. 9al) similar to those of cereals, and a broad area of starch parenchyma,









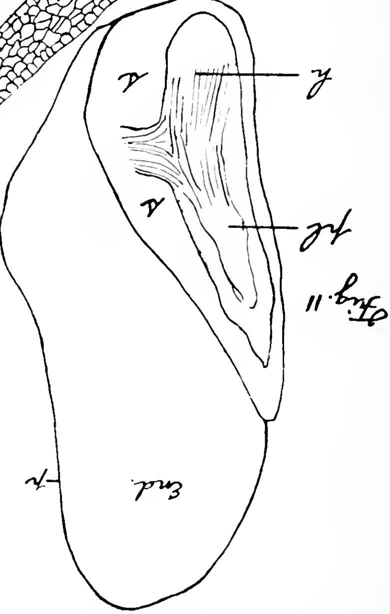


Fig. 8. Fruit of *Cenchrus tribuloides* L. showing scar at base (h); endosperm area (end); embryonic area (emb) and style (s).

Fig. 9. Transverse view of outer portion of *C. tribuloides* fruit from section cleared with chloral, showing epicarp (e); hypodermis (h); irregular shaped, beaded-walled cells (b); tube cells (t); spermoderm (s); aleurone cells (al); starchy endosperm (end), (highly magnified).

Fig. 10. Starch grains from cells of starchy endosperm of *C. tribuloides*.

Fig. 11. Diagrammatic sketch of median longitudinal section of *Cenchrus tribuloides* caryopsis, showing regions of fruit wall and seed coat (p); endosperm (end); scutellum (s); plumule (pl); cotyledonary sheath (cot); and hypocotyl (h).

Fig. 12. Median longitudinal section through embryo of *Cenchrus tribuloides*, showing details of its various parts. Epidermis (ep), and parenchyma (p) of scutellum; cotyledonary sheath (cot); plumule (pl), and hypocotyl (h).

the cells of which are polygonal in outline and filled with starch grains. The latter (Fig. 10) are for the most part simple, but occasionally two-compound. The larger grains vary in outline from spheroidal to polygonal to rounded-polygonal and show a several cleft hilum and often concentric striations. They are mostly 22 to 25 μ in diameter.

The embryo (Fig. 12) consists of a good-sized scutellum, a cotyledonary sheath, a plumule and a hypocotyl. The epidermal cells of the scutellum are hyaline and the parenchyma cells beneath are loaded with starch granules, which are much smaller than those found in the endosperm.

Histology of the Stem.

The outer surface of the stem of this plant shows a pronounced longitudinal grove and a number of longitudinal striations. Transverse sections exhibit, therefore, a sub-circular outline with a broad, shallow indentation and a number of smaller sinuses along the margin.

The epidermis (Fig. 13*e*) is composed of thick-walled yellow cells with prominent outer cuticle. The outer walls of these cells are convex in cross section. In surface sections, the Epidermis (Fig. 14) shows the characteristic long (*l*) and short cells (*s*) of the grasses. The long cells have porous side and end walls. Stomata (*st*) are present.

Directly beneath the epidermis along the broad grove is a zone of four to five layers of yellowish sclerenchyma fibers with strongly lignified walls, forming the sclerenchyma sheath (Fig. 13*sch*). Elsewhere several layers of cortical parenchyma cells (*c*) are evident underlying the epidermis with the exception of the ridges between the striations which are strengthened by about four to six layers of sclerenchyma fibers (*f*). There is no distinct endodermis. The sclerenchyma sheath surrounds some of the closed collateral bundles. In some instances bundles are attached to it along its inner edge.

Just within the sclerenchyma sheath is a broad pith (*m*) filling up the center of the younger stem. Coursing through this are to be noted a number of additional closed collateral bundles (*b*) that are not attached to the sclerenchyma sheath. Each of these is surrounded by a band of sclerenchyma fibers (*scl f*). Annular, spiral and pitted tracheæ are present in the xylem of the bundles.

The pith is composed of polygonal cells and moderate sized, angular, intercellular-air-spaces. The cells are broadest in the center and break down in this region of the internodes of the older stems.

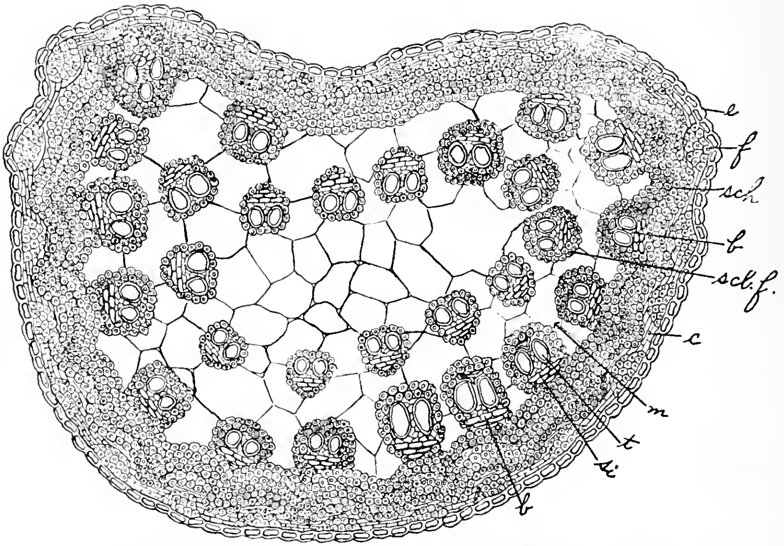


Fig. 13. Transverse section of stem of *Cenchrus tribuloides* L. showing epidermis (e); group of hypodermal fibers (f); sclerenchyma sheath (sch); closed collateral bundle (b) attached to sclerenchyma ring; tracheæ (tr) and sieve tubes (si) of bundle; sclerenchyma fibers surrounding bundle (scl. f.); cortical parenchyma (c); pith (m), (greatly magnified).

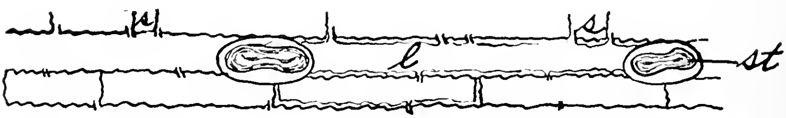


Fig. 14. Surface view of portion of epidermis of stem of *Cenchrus tribuloides* L. showing stomata (st) long cell (l) and short cell (s), (greatly magnified).

The Chemical Composition of Cenchrus Tribuloides.

The chemical composition of the various members of the *Gramineæ* which have been subjected to more or less thorough analysis, have, as a rule, shown nothing in the way of toxic and irritating principles. The material used in the following analysis consisted of the mature fruits of the plants furnished by Dr. H. Marshall Taylor, of Jacksonville, Florida, pulverized in an iron mill to a fineness of a No. 60 powder.

The ash determinations and analyses were made upon unground material so as to eliminate any possible source of contamination from the milling. The ash on a number of closely agreeing determinations averaged 3.95 per cent. Of this about 10 per cent. was silica, while qualitative tests showed the balance to be made up of compounds of potassium, calcium, manganese and iron.

The moisture in the air dried, powdered material was found to be 8.17 per cent.

The water soluble extractive was found to be 3.55 per cent., of which 0.55 per cent. was reducing sugars, the balance being mucilaginous in character. Tests were made upon the watery extractive matter for alkaloids and glucosides, with negative results. Starch and tannin were also absent. Mucilage was present. Positive tests for an aldehyde were obtained in the aqueous extractive, but the specific identity of the substance could not be determined owing to the smallness of the amount. The reaction of this aqueous portion was very faintly acid, but here again the amount was so small that identification of the acid became impossible.

The alcoholic extractive amounted to 3.17 per cent., mainly chlorophyll and resinous and oily constituents. No alkaloids or glucosides.

The petroleum-ether extractive amounted to 2 per cent., principally fat.

The extraction with ethyl ether showed 3.3 per cent. The acid number of the ether extract was 19.10, the saponification number 197, and the iodine number 60. It is certain that there is not present any alkaloids, glucoside or similar toxic principle.

Physiological tests were made of the various extractives to determine the possible presence of specifically irritating substances, either by taste or inoculation into a pin prick, but the material appears to be devoid of activity or irritating properties.

A careful search of the literature shows no evidence of chemical work having been done upon this plant at any time in its history.

The foregoing data was indicative of the fact that in the mature state at least, the fruits of this plant are entirely free from constituents of an actively toxic or irritating character.

LIST OF ILLUSTRATIONS.

Fig. 1. *Cenchrus tribuloides* L. x ⅓.

Fig. 2. Burs of *Cenchrus tribuloides* L. (natural size).

Fig. 3. *A*. Spine *of Cenchrus tribuloides* L. showing barbs (b) below and unicellular hairs (h) above. *B*. Portion of epidermis of spine showing insertion of hair (h) between epidermal cells (e). *C*. Barb enlarged.

Fig. 4 (A. B. C. D. E.). Diagrams of cross-sections through several regions of the spines of *Cenchrus tribuloides* L. showing the character of the vascular areas (v) from base to near the tip of the spine.

Fig. 5. Transverse section through the spine of *C. tribuloides* L. near its termination showing barbs (b), sclerenchyma fibers (sch.) and vascular tissue (v).

Fig. 6. Fruit of *Cenchrus tribuloides* L. invested by palet.

Fig. 7. Surface view of epidermis of palet showing long cells (l); twin cells (s) and base of hair (h).

Fig. 8. Fruit of *Cenchrus tribuloides* L. showing scar at base (h); endosperm area (end); embryonic area (emb) and style (s).

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Fig. 14. Surface view of portion of epidermis of stem of *C. tribuloides* showing stomata (st); long cell (l); short cell (s).

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NOTES ON THE MILK PROBLEM.

By Henry Leffmann, A. M., M. D.

The detection of adulterations in market milk constitutes one of the most important and difficult problems of food control. Milk is one of the few foods largely eaten raw, and, hence, sanitary control must include not only variations, natural or intentional, in the proportions of the ingredients, but the detection of pathogenetic organisms. At any point in the collection and distribution of milk contaminations may occur. The attention of sanitary chemists has been most largely concentrated on the determination of the limits of the principal constituents, especially proteins and fat, and a vast amount of data has been accumulated in the last fifty years, but much of the earlier work is vitiated by the use of erroneous methods. Wanklyn made systematic investigations of the composition of milk samples as offered in London, using a process of ether extraction which is now known to be defective, but he did good service in calling attention to the adulteration of milk supplied to public institutions, and his results, published in book form, became a starting point for other workers. He showed, among other things, that the lactometer, as then used, was not a trustworthy instrument, since it was possible to manipulate milk so as to preserve its gravity although fat was withdrawn and water added. The present condition of milk lactometry was fully discussed by Horn in a recent issue of this journal.

Nearly a half century ago, the British Society of Public Analysts took up the question of the limits permissible for market milk. The British Food and Drugs Act did not establish any standards, but simply provided that the article sold should be "of the nature, substance and quality demanded by the purchaser," hence it became necessary for the local analyst to state what was the composition of

the normal substance. The Society adopted certain limits which were believed to be liberal, that is, not setting too high a composition, yet as Dr. Paul Vieth said, in the discussion, "It must be remembered that the cows have not been asked, nor given their opinion on the question, and they may sometimes give milk below standard." Strict control over the composition and cleanliness of milk finally spread over the whole civilized world, yet some of the features of the problem are still not fully solved.

A satisfactory method of detecting added water has always been much desired. In early days it was thought that the detection of nitrates might give a clue, but this was found to be of no practical value. The employment of the immersion refractometer was a great step forward, since it was shown that milk serum prepared by the copper method from an unwatered sample, will not fall below the reading of 36, though it is recognized that a dilution of ten per cent. might be made to some samples without the reading falling below this figure. Passing over some other suggestions which have gone to the limbo of forgotten things, it will be of interest to present some data concerning the latest and most promising of the procedures for detecting watering. This is the determination of the freezing point.

An interesting summary of the application and results of cryoscopy applied to milk samples is presented in the recently published twenty-sixth annual report of the Connecticut Agricultural Experiment Station, being the report on food and drugs for the year 1921. The report was prepared by Dr. E. M. Bailey, chemist in charge of the Analytical Laboratory. The section on milk is only one of many comprising the whole range of laboratory work during the year, and does not enter into the theory and methods applying freezing point determinations. Information on those lines will be found in a paper by Hortvet in *Jour. Ind. Eng. Chem.* 1921, 13, 198. Hortvet has outlined a standard method. Dr. Bailey's data are compiled not only from his own work, but from that of numerous co-workers whose services are duly acknowledged. Four types of investigations were carried out. Milk from normal cows, normal herds, normal cows under somewhat abnormal conditions, diseased or physically abnormal cows.

The freezing point of milk is a physical constant ranging within narrow limits, that is, from —0.530° to —0.566° C. As the depression is due to salts in solution, addition of ordinary water will

diminish the influence of such salts, and the freezing point will be nearer the zero. Results are given of determinations on nearly three hundred samples, many in duplicate, with partial or complete chemical analysis. The inferences drawn from the investigation are as follows:

There is an appreciable difference in freezing point depression between morning and evening milk, the variation being greater than that observed between morning or evening samples respectively from day to day.

Minimum depressions ranging from —0.530° and the maximum of —0.566° from normal individual cows, and for normal herds a minimum of —0.5930° and maximum of —0.562° are reasonably substantiated.

Moderate exercise or moderately delayed milking does not appreciably affect the freezing point. Long-delayed milkings or severe exercise, strain or fatigue may give materially increased depressions.

The milk from tubercular cows or those in poor or abnormal conditions has generally fallen within the limits of normal milk, but some instances of decreased depression have been noted.

Some points, especially the effect of disease and abnormal conditions still remain for further study. It appears that in the freezing point method the chemist has a satisfactory procedure for the detection of watering.

The milk problem is by no means limited to the mere detection of skimming and watering. *Clean milk,* that is, milk free not only from pathogenetic organisms, but from the common putrefactive forms is necessary to the well-being of the community. Collection of the milk from healthy cows by clean, healthy milkers, transportation to market under proper conditions, distribution to consumers so as to prevent any contamination are essential. Much has been done of late years to bring about these controls. The large companies engaged in the handling are well equipped and efficient and it seems that the milk problem will never be fully solved until individual dairymen and purveyors are eliminated and the entire service is in the hands of those who can command scientific supervision at every point.

HAY FEVER DIAGNOSIS AND TREATMENT.*

By Ivor Griffith, Ph. M.

Newer developments in the field of hay fever diagnosis and therapeusis have completely eclipsed the theories and practices indulged in when this field was first cultivated. This, of course, is the general turn of affairs when any new medical idea is promulgated, for it is only by experience and experiment that the true value of medical discoveries may be obtained.

Formerly it was held that hay fever or pollinosis was due to the unusual sensitiveness, or idiosyncrasy of the sufferer to the pollen of a vast variety of plants out of Nature's garden. But Nature's garden is expansive, and the old conception of diagnosis meant that a large analytical botanical chart was followed in order to establish the sensitiveness of the person under examination. As time went on, however, it was found that a real majority of patients responded uniformly only to a small class of pollen proteins. Then again when closer study was made of pollination methods, it developed that comparatively few plants use the simplest way of broadcasting their pollen grains, namely by trusting it to the wind. And it is wind-borne pollen that is responsible for most hay fever infections.

So we find, as time went on, that the diagnosis and treatment of hay fever causes became more simplified, and particularly so by the brilliant conception of a "grouping" of the pollen extracts. Investigation proved conclusively that patients who are sensitive to pollens may be "botanically" classified according to plant families. This botanical relationship of the pollens has even been carried so far as to conceive that patients who are sensitive to more than one pollen of the same family may be treated (or desensitized) by using a pollen extract belonging to only one member of that family, the one chosen being generally the one affording the most pronounced reaction in the diagnostic test.

Scheppergrell, the pioneer in this field of investigation, reduces the principal hay fever pollens into four groups as follows:

Group 1. Gramineæ (the grasses).

Group 2. Ambrosiaceæ (the ragweeds).

†Read before the monthly meeting of the Staff of the Stetson Hospital.

Group 3. Chenopodiaceæ (the chenopods).
Group 4. Artemesias (the wormwoods).

This is a natural botanical grouping. Scheppergrell further summarizes the gross characteristics of hay fever plants as follows:

(1) They are wind pollinated.

(2) They are prolific.

(3) The individual plants are inconspicuous as to color and odor, and pollen formation is very active.

Now then the simplified character of present methods of hay fever diagnosis and treatment may be exemplified thus. If a given person is sensitive to corn pollen or red top or orchard grass, he may be desensitized with the most prolific member of the group (the gramineæ) namely, timothy. This class or group is generally termed the spring group, and is responsible for the early hay fever. Thus again ragweed will desensitize not only against ragweeds but also against closely related plants of the same group such as cockleburs, golden rod and red root. Sometimes, however, in the case of multiple sensitiveness it is necessary to use in addition to the class or group representative, the other members of this group to which the patient displays sensitiveness. This is not resorted to until it is established that the patient is not deriving any benefit from treatment with the group representative.

The botanical grouping referred to has displaced the older seasonal grouping, and it is no longer considered good practice to label the treatment products as Fall, Mixed Fall, Spring or Summer extracts.

Group 1 and Group 2 are the most common offenders. Group 3 includes a heterogeneous collection of plants of wide distribution, which are important contributing agents in the perennial hay fever cases. The long blooming dock, *Rumex crispus* is probably the major offender in this group. Group 4 includes the several species of the prolific wormwoods which are the chief causes of hay fever in the Pacific and Rocky Mountain States.

In preparing these agents for the market, the pharmaceutical houses have used several methods, each manufacturer selecting a special procedure and insisting that the chosen procedure is best. There is, therefore, a wide disparity in the potency and dependability of pollen proteins. It is our experience, however, in using

these pollen extracts in the laboratory, that the acetone insoluble pollen of the alkalinized aqueous extract of the sifted, dried pollen, yield best results for both diagnosis and treatment. The protein nitrogen content is high and they are more uniform and stable. Knowledge of the protein nitrogen content,* is valuable since it is necessary to use this datum in order to establish the pollen unit.

A word or two in regard to the conduct of the test and the mode of treatment.

Diagnostic Tests.

The technic of the cutaneous test, which is by far the preferable, is as follows: Cleanse patient's forearm with alcohol and rinse well with sterile water. With a sharp needle make a small linear scratch about one-eighth inch long on the skin of the forearm and avoid drawing blood. Place a small drop of a N/100 NaOH solution on the scarified area. Over this dust some of the pollen extract and rub gently but thoroughly into the scarified area. This is repeated at two inch linear intervals with the other extracts. It is always necessary to run a control scarification, using only the N/100 NaOH. The results are recorded twenty to thirty minutes after applying the tests.

Positive reactions vary in their intensity and no reaction is considered positive that is not definitely larger than the control reaction. A marked positive reaction consists of a definite urticarial wheal with a surrounding area of erythema. A moderately positive reaction shows a similar picture, except that the characteristics are not so pronounced. A mild reaction shows very little of the wheal but a distinct area of erythema. The protein or proteins giving reactions are usually the cause of the symptoms. After ascertaining the cause in this manner, the treatment is next considered.

Prophylactic Treatment.

Prophylactic treatment should begin four to six weeks before the attack is scheduled, and from twelve to twenty injections given. As soon as the specific pollen occurs in the atmosphere, however, the dose must be reduced, as the patient is additionally exposed to atmospheric pollen.

*Noon establishes the following factor for all pollen proteins: .001 = 1 pollen unit.

The injecting solution is prepared from the pollen extract, so that a cc. represents about 100 units (calculated on the basis of N times 6.25 content). These solutions may be procured from the manufacturers and so may all of these products, both diagnostic as well as the therapeutic agents.

The accepted scheme of dosage is as follows:

Dose	*No. of pollen units*
1	12.5
2	25
3	50
4	75
5	100
6	125
7	150
8	175
9	200
10	225
11 to 20	250

In conclusion our experience has been that a large percentage of cases of hay fever infection can be modified if not cured by the pollen extract treatment.

ABSTRACTED AND REPRINTED ARTICLES

PHARMACOGNOSY AND THE PHARMACEUTICAL CURRICULUM.*†

By H. G. Greenish, D. Sc. (Paris), F. I. C., F. L. S., Ph. C.

As text of the address which custom requires that the President of the British Pharmaceutical Conference should deliver at the annual meeting, I propose to take the subject of "Pharmacognosy and the Pharmaceutical Curriculum." I have selected this subject partly because it is one of which I may claim to have some knowledge, but chiefly because I look upon pharmacognosy as a field of knowledge which the pharmacist is peculiarly fitted to cultivate, and in which he should have a claim to be considered an expert. The

*From the *Chemist and Druggist*.

†Presidential address before the British Conference.

Pharmaceutical Society, with its museums, herbaria, laboratories, library and school, and with its fine record of eighty years, is entitled to and should regard itself as the headquarters of pharmacognosy in this country, as the body to which reference should be made for any information respecting crude drugs. This position can be retained only by maintaining those sections of its activity that relate to pharmacognosy in a state of the highest possible efficiency. I propose, therefore, to indicate the scope of the subject, to outline the training which, in my opinion, the pharmacist should undergo to enable him to possess expert knowledge of it, and to point out a few of the many details upon which research is necessary. For without research no real progress is possible, and this fact must be borne in mind when arranging a curriculum for the student, and also when allotting lectures and practical work to the teachers. Both the University of London and Board of Education recognize the necessity for research work by the teachers, and insist that they shall be allowed sufficient freedom from lectures and administrative work to allow them to prosecute research in their various departments.

Pharmacognosy Defined.

It will be desirable first of all to be quite clear as to what we mean by pharmacognosy. I have heard it defined, or, perhaps, rather described, as the "spotting of drugs." I have heard it said that all the pharmacist needs to know is what the drug is, what it costs, and how long it will keep. If the authors of these descriptions were in earnest, they must have had a very limited experience of pharmacognosy, and a very poor opinion of the knowledge that a pharmacist ought to possess.

According to Professor Tschirch, the term "pharmacognosy" was first used by Seydler as the title of a small work which he called "Analecta Pharmacognostica," published in 1815. It was adopted in 1825 by Martius, who explained it to mean the discipline that investigated remedial agents from all three kingdoms of Nature as regards their origin and quality, tested them for purity and examined them for substitution and adulteration. Subsequently the drugs derived from the mineral kingdom were separated from pharmacognosy and formed the basis of pharmaceutical chemistry. Professor Tschirch, who, it will be remembered, as Hanbury Medallist delivered the inaugural address at the opening of the School of Pharmacy in 1909,

defines pharmacognosy as that science which deals with the investigation of drugs of animal or vegetable origin from all points of view (excepting only that of their therapeutical action), which aims at acquiring an accurate scientific knowledge of them, at describing them correctly, and at welding our knowledge of them into a scientific entity based on the chemical relationship of their active constituents.

Such a knowledge of pharmacognosy presupposes a knowledge of botany, chemistry, physics, and elementary zoology; it embraces geography, history, ethnology, and etymology, at least as applied to drugs; it includes the collection, preparation, and commerce of drugs. This represents what one of the most advanced thinkers in pharmacognosy understands to be the object of the science, and while doubtless many may differ in some respect or other, there can be little doubt that in the main it is correct.

Such are the subdivisions of scientific pharmacognosy as defined by Professor Tschirch, and they must be mastered by those who aspire to teach pharmacognosy; but it does not by any means follow that they should be mastered by the student of pharmacognosy or by the practical pharmacist. It is for the pharmacist to utilize the results arrived at by the scientific pharmacognosist and turn them to practical account. Thus it is for the scientific pharmacognosist to investigate the structure of vegetable and animal drugs in the minutest detail, and to point out distinguishing features, but it is for the practical pharmacognosist that is the pharmacist, to utilize these results in order to enable him to recognize the drugs, to distinguish them from possible substitutions, to detect adulteration, to judge of their quality by their physical characters, to identify them when powdered, and to determine the purity of the powder. The pharmacist should further be in a position to apply the results of the chemical investigation of drugs to the determination of their quality by chemical assay, and he should, in addition, have a knowledge of indigenous medicinal plants, and also of indigenous toxic plants, even if these are seldom employed medicinally.

Applied Pharmacognosy.

There are doubtless many pharmacists, especially among those who view the subject from a purely utilitarian point, who consider that this knowledge may be sufficiently acquired by the pupil during his pupilage in a pharmacy. In refutation of this, let me quote to

you the pertinent remarks of Dr. A. T. Thompson, in his first lecture on materia medica to the students of the School of Pharmacy in 1842. He said: "It may be argued that the daily occupations in the laboratory, in the storehouse, and in the shop of the chemist and druggist are sufficient, and perhaps the best mode of teaching the pupil the knowledge of the physical characters of drugs, and the leading features by which the good are distinguished from the bad; the position is certainly not devoid of force. Experience and observation are the means of acquiring such information; but we may have eyes and yet not be capable of employing the vision they bestow to advantage. How many thousands pass from the cradle to the grave without having made an accurate observation with respect to objects daily presented to their view! And if it is a just remark that the painter enjoys a double sense of vision, I must contend that it is requisite to educate the powers of observing in order to observe well; and need I argue that he who understands the branches of science to which I have referred (zoology, botany and mineralogy) is more likely to attain a correct acquaintance with physical characters than he who has merely had his eye directed to them without any systematic method of examination and of comprehending the causes of the variety they display." As the purely utilitarian point of view is not infrequently advanced as a reason for learning as little as possible about anything unless what is learnt is directly translatable into pounds, shillings and pence, allow me to explain why, in my opinion, the pharmaceutical student should learn as much as possible about pharmacognosy and the sciences allied to it, particularly botany and pharmaceutical chemistry. As a member of the community, it is the chief duty of the pharmacist to provide the public with medicines, simple or compound, of the proper quality. These medicines consist of, or are prepared from, either vegetable or animal drugs on the one hand, or from more or less pure chemical substances on the other, and it is the business and duty of the pharmacist to have as thorough an acquaintance as possible with them in order that he may be equal to the responsibilities he has undertaken. The utilitarian is, of course, perfectly entitled to his point of view. No valid objection can be raised to the sale of perfumes and hair-brushes by the pharmacist, but it is for those among us—and I hope they are many—who have higher ideals of pharmacy to see that the desires of the utilitarians are not carried into effect to the prejudice of the true interests of pharmacy.

Preliminary Requirements.

In order that the student may be capable of understanding and appreciating a course of instruction in scientific pharmacognosy, there can be no question that he should have had a thorough grounding in botany, chemistry and physics, and that he should possess an elementary knowledge of zoology. But, in addition to these sciences, he must also have had a preliminary general education of a distinctly higher standard than that which at present obtains with the majority of the entrants into pharmacy. He must have a good knowledge of geography (including physical geography) and of the history of the world, and a training in commerce and economics would be of distinct advantage to him. It is impossible for him to be in this position unless his preliminary education has been of a standard commensurate with the demands that will be made upon him, and one of the most hopeful signs for the progress of pharmacy in the future lies in the now generally accepted opinion that a considerable elevation of the standard of preliminary education is essential. The decision of the Pharmaceutical Society in 1897 to retain the Junior Examination of the College of Preceptors as one of the entrance examinations to pharmacy was fatal to real progress. This decision was apparently the result of a dread felt by many members of the Society that a raising of the standard of the entrance examination might be accompanied by a restriction of the number of entrants, and that consequently the aid necessary to pharmacists for the conduct of their businesses would be more difficult to obtain and command a higher remuneration. If this was really the case, then the future true welfare of pharmacy was sacrificed for the sake of present advantage. What has been the result? For the past quarter of a century the entrance examination into pharmacy has remained the same, while the standard of general education throughout the country has been steadily rising and the facilities for obtaining that education steadily increasing. In the years 1903-1913 about 70 per cent. of the students entering the Society's School of Pharmacy had attained the standard of education demanded by the easiest entrance examination only. I do not think I am exaggerating when I say that a large proportion of the entrants into pharmacy during the past twenty years have not been able to work out simple arithmetical sums and have been sadly lacking in general knowledge and in the powers of observation and deduction. Teachers have been attempting to erect a solid edifice

upon the most insufficient foundations, and in many cases the task has been too great.

In the Report of the Royal Commission on University Education of London, the Commissioners said that:

"A university works by the co-operation of its teachers and students in study and investigation, a process in which the student is trained to learn in an inquiring spirit, and the teacher is assisted in his endeavors to advance knowledge by the effort to communicate it to others, and by the stimulus which the youthful doubts and enthusiastic labors of his best students afford him. This co-operation, however, cannot be effectively realized unless certain conditions have been fulfilled. In the first place a sound general education is an indispensable basis of the undergraduate students' work. It is no doubt possible for a considerable amount of knowledge of a specialized kind to be acquired upon a relatively meagre groundwork of general education; but for the ordinary student a point is reached sooner or later, and more often soon than late, where all further advance is hampered, if not entirely prohibited, unless he has acquired the power of accurate expression and orderly thought. These are the two intellectual qualifications, which, stated in its most general terms, it is the aim of a sound general education to give, and if they do not exist, a large part of the benefits of a university training will be lost."

The Order of Study.

Assuming for the moment that a rise in the standard of preliminary education of the pharmacist is an accomplished fact, and that the student has passed his entrance examination, let us consider what should be his next step to fit himself for the study of pharmacognosy. Naturally a training in botany is the most important, as nearly all the drugs dealt with by the pharmacognosist are of vegetable origin. Should this knowledge be acquired before his pupilage in the pharmacy or afterwards? On this point opinion varies, not only in this country, but on the Continent also. In Belgium the scientific training precedes the practice in the pharmacy; in France the practice in the pharmacy precedes the scientific training. In either case the scientific training is continuous, and the whole time, energy and thought of the student is devoted to it. In this country the entrant into pharmacy is debarred from adopting the Belgian plan in its entirety, since he must have spent at least two years in a pharmacy or approved institution before he can present himself for the second or final part of the qualifying examination. He may adopt, and in

the past almost invariably has adopted, the French plan and passed through his pupilage before commencing his scientific studies. Sir David Prain, in his admirable address to the students of the School of Pharmacy last year, vigorously supported this arrangement and based his arguments largely upon the result of his experience as Director of Key Gardens. The late Professor Bourquelot also, one of the most advanced of pharmacists, was a strenuous advocate of the system, stating that his observation of the students who had passed through his hands was that the course of training in the pharmacy was invaluable for fostering and developing a scientific spirit in the pupils, and for giving them a thorough training in habits of neatness and cleanliness, and in the skillful manipulation of apparatus, which are of the greatest service to them in their scientific studies.

But the student of pharmacy in Great Britain may, under present regulations, adopt an intermediate plan. He may pass the first part of the qualifying examination before his pupilage and the second part after. In this case the continuity of his studies would be interrupted for two solid years. I have no doubt whatever that such an interruption would be a very severe handicap to him. Every teacher of botany, chemistry, or pharmacognosy who has had students return to him after an interval of two years spent in the practice of pharmacy knows the amount that can be forgotten in that time. We have had, unfortunately, sufficient experience of this in the case of those who, compelled by the war to abandon their studies, have returned to them after three or four years to find that they had not only forgotten much, but had to a great extent lost the habit of study. These men and women, who have thus suffered through no fault of their own, have our intense sympathy. But the pupil who has the option of making his study continuous or discontinuous and chooses the latter has only himself to blame if, later on, he finds himself handicapped. That he will be handicapped is, to my mind, certain. If he were dealing with botany alone, he might during his pupilage in the pharmacy maintain a certain continuity by means of evening or other classes, but when one considers that he would have to devote at least an equal period to physics and a much longer period to chemistry, then such a task, in conjunction with the daily work in the pharmacy, is more than any but the most robust can endure. If the pharmaceutical pupil decides to take his pupilage in the phar-

macy before his systematic course of study, then attendance at evening classes at one of the various technical schools may be useful, but such attendance must be strictly commensurate with his physical and intellectual vigor, and allowance must be made for the necessary time for homework in the same subjects. Such classes in botany, for example, may form a useful preliminary to, but cannot in any way replace, a systematic day course in a properly equipped institution as a groundwork upon which the study of pharmacognosy is to be based.

The Influence of Botany.

Let me now turn for a moment to consider the influence that may be exercised by the nature of the course of botany through which he passes. Without going into too much detail, I think it will be generally admitted that a course of general botany in which the illustrations required are drawn from drugs or from medicinal plants, and in which special attention is devoted to those sections that will be most needed by the pharmacognosist, such as anatomy, morphology, physiology and systematic botany, will best fit the student for the application of his knowledge on the study of pharmacognosy and eventually to the solution of its problems. At the same time it should be so broad that if at a later period the pharmacognosist desires to apply the principles of genetics to the cultivation of medicinal plants, he should at least have a foundation on which to build. In courses of general botany so little detailed attention is usually paid to the anatomy of plants that pharmaceutical students have to give to that part of their work time that should be devoted to the application of such knowledge to the examination of drugs. In the School of Pharmacy, and probably in other institutions in which the training is specially arranged for pharmaceutical students, this disadvantage does not obtain, as the botanical course is properly co-ordinated with the course in pharmacognosy to the distinct advantage of the student. Should the Society decide to accept for Part I. the certificates of other examining bodies, as, for instance, the Intermediate Examination for the degree of Bachelor of Science, then either such students must be placed under a disadvantage, or the courses in pharmacognosy must be adapted to suit them. In botany, at least, there is no doubt that the course best suited to the pharmaceutical student is one specially adapted to the particular objects that he has in view.

Some years ago the Minister of Education in Austria, referring to the introduction of a new curriculum and examination for pharmacists, said that care was to be taken that, as far as possible, the lectures and practical work in the various sciences should be specially designed for students of pharmacy. With that I cordially agree.

Pharmacognosy as an Examination Subject.

Let me now turn to pharmacognosy as a subject in the final part of the Qualifying examination, and inquire to what extent the student may reasonably be required to carry his acquaintance with it. Obviously, he should be required to be familiar with all the crude drugs described in the British Pharmacopœia. To these might be added other unofficial drugs such as those that form the basis of galenical preparations occasionally if not frequently prescribed or demanded by the public. To ensure that the candidate has had sufficient training in practical work and has not contented himself with a superficial recognition of the drug without knowing, searching for, and finding the diagnostic characters, he should be required to demonstrate these diagnostic characters to the examiner, using for this purpose either qualitative chemical tests or examination by means of the lens, or, if necessary, by means of the microscope. As the candidate will have already received the requisite preliminary training in botany, examination by means of the microscope, even if the cutting of a section is necessary, should present no difficulty. He should further be required to have a general knowledge of the chief constituents of the most important drugs, of their localization, of the secretory tissue in which opium, turpentine, myrrh, etc., are contained. To put it briefly, the time has arrived when the training and examination in pharmacognosy should be directed towards imparting to and requiring from the candidate a more thorough, a more scientific, and a more practical knowledge of crude drugs. Such requirements will have the advantage of checking a far too prevalent disposition to make the subject almost entirely a pure effort of memory.

With the conditions under which the pharmacognosy will, in the very near future, be taught, bearing in mind the large number of institutions that have been approved for the purpose, a syllabus of the examination will, I suppose, remain a necessity, although the length of the course and the number of hours to be devoted to the subject should be a sufficient guide to both teacher and examiner.

The Royal Commission in their Report condemned the syllabus by saying:

"The syllabus is a device to maintain a standard among institutions which are not all of university rank. The effect upon the students and the teachers is disastrous. The students have the ordeal of the examination hanging over them and must prepare themselves for it or fail to get the degree. Thus the degree comes first and the education a bad second. They cannot help thinking of what will pay; they lose theoretic interest in the subjects of study, and with it the freedom, the thought, the reflection, and the spirit of inquiry which are the atmosphere of university work. They cannot pursue knowledge both for its own sake and also for the sake of passing the test of an examination. And the teachers' powers are restricted by the syllabus; their freedom in dealing with their subject in their own way is limited; they must either direct their teaching to preparation for an examination which is for each of them practically external, or else lose the interest and attention of their students."

The problem is not an easy one to solve, but in the interest of the education of the student as contrasted with preparation for examination, the attempt to solve it should be made, and in the case of the subject with which I am dealing its solution should not be an impossible task. In any case the syllabus, if syllabus there must be, should be couched in terms as general as possible, and both teachers and examiners should be pharmacists, either men or women, who have received a thorough training in scientific pharmacognosy.

Advanced Training in Pharmacognosy.

The next question to be considered is the nature and scope of the advanced training in pharmacognosy to be undertaken by the student who has passed the qualifying examination. Undoubtedly a more thorough acquaintance with the minute structure of the more important drugs and an efficient training in the identification of powdered drugs the determination of their freedom from adulteration, and the analysis of mixed powders should occupy the first position. The student should also acquire such a knowledge of the chemical methods of assaying drugs as to allow of his undertaking such work with confidence in his results, and he

should extend his general knowledge of the active constituents of the more important drugs and their relation to one another. The examination in pharmacognosy for the Major qualification should be based on similar lines. In this respect I think it is generally admitted that the present examination is lamentably defective. It is imperative that the time allotted to it should be doubled, and that the scope of the examination should be revised.

The remark is frequently made that the Major qualification is of little or no direct advantage to the pharmacist in business. If an embryo pharmacist determines to become and remain a trader pure and simple, deriving an income from his trading without a thought of advancing himself in a knowledge of his craft beyond the minimum legal requirements, and without a desire to raise the standing of his craft beyond that of a trade, he is at liberty to do so. But it is inconceivable to me that any intelligent pharmacist should hold the advantage of a thorough education in his craft in so little esteem and have so poor an opinion of his own ability to profit by it, as to refrain from carrying his training to the highest possible limit of his financial position. The words of an editorial article, probably by Jacob Bell, in the "Pharmaceutical Journal" of 1847, apply with equal force today:

"The existence of such an institution (the School of Pharmacy) was an innovation, an inroad on the accustomed prejudices of a body of tradesmen who had been accustomed to estimate every advantage, whether moral, social, or political, by pounds, shillings and pence; and we were from the beginning quite prepared for the inquiry. How much shall we gain by it? It would be difficult to convince a child that by learning his A. B. C. he is acquiring the means of subsistence, but it ought not to be difficult to convince a chemist that by obtaining a knowledge of his profession he is deriving a similar advantage."

There is some indication it is true, of an increased desire on the part of those who have passed the Qualifying examination to proceed to the Major, but it is not possible to estimate the exact position. I am well aware that certain suggestions have recently been made with the object of adding to the value of the Major examination and so attracting more candidates. These suggestions do not, however, touch the subject of pharmacognosy, so that I must content myself with simply stating that in my estimation the pharmacist should master the work that is his own

before he attempts to acquire expert knowledge of other branches of science.

Post-graduate work in pharmacognosy and the problems in pharmacognosy that await solution must next claim our attention. Although the Pharmaceutical Society has provided research laboratories and offered inducements to advanced students to carry out investigations in them, the number that have availed themselves of the offer has not been large. The reason for this is probably to be found in the absence of any tangible reward for the time and labor expended. Consequently the pharmacist who has passed the Major examination and wishes to continue his studies usually aims for the degree of Bachelor of Science of the University of London or the Fellowship of the Institute of Chemistry, and with either or both of these he is usually content. Neither of them involves the necessity for research work; consequently it is seldom that he carries out any research, with the result that he loses an invaluable training, and pharmacognosy is deprived of a contribution to the solution of one at least of its problems. Indeed, it is not too much to say that the training in scientific pharmacognosy is incomplete until the student has carried out at least one research in some branch of the subject.

A Post-Graduate Student's Goal.

Recent regulations of the University of London have, however, considerably altered the position of students of pharmacy by bringing within their reach a tangible reward for their post-graduate studies. I allude to the degree of Doctor of Philosophy. The conditions for taking this degree are not very onerous. The candidate must have graduated in the faculty of theology, arts, science, or economics in the University, or in an approved foreign university, at least two years previously, and must submit to the University for approval the subject of a thesis which must form a distinct contribution to the knowledge of the subject chosen and afford evidence of originality; he must also submit to an oral or written examination on a subject relevant to the thesis. After taking the degree, the candidate may proceed to a higher degree in the same faculty. An internal student must carry out the research for his thesis under the supervision of a recognized teacher of the University, though not necessarily in the laboratory of one of the constituent colleges of the University. Under these conditions it is possible for both internal

and external students to carry out the work for their theses in the research laboratories of the Pharmaceutical Society, and at the present moment a graduate of a foreign university is so working in the pharmacy research laboratory, the subject of his thesis, which has been accepted by the University, embracing work in the field of pharmacognosy, both on the botanical and chemical sides. Such work is of inestimable value both to the post-graduate student and to the teacher. The very condition that the thesis "must afford evidence of originality" encourages them to develop their work along their own lines of thought, and liberates them completely from the strangling influence of a syllabus.

A number of the more advanced students of the School of Pharmacy, after passing their Major examination, proceed through the Intermediate Examination in Science to the degree of Bachelor of Science. There is now an additional inducement for them to continue their studies, and by means of research work carried out in the Society's research laboratories, proceed to the degree of Doctor of Philosophy. The progress of such students eventually to the degree of Doctor of Science would be much facilitated if arrangements could be made with the University to accept pharmacognosy as one of the subjects for the degree of Bachelor of Science on lines similar to those adopted some years ago in the Universities of Manchester and Glasgow.

The field of pharmocognosy is so wide and the problems that await solution are so diversified in their nature that no difficulty will be encountered in selecting subjects for theses that will appeal to the varied abilities and special qualifications of post-graduate students, who will doubtless be encouraged to put forth their utmost powers to give their work a claim to be classed with the researches of eminent pharmacists who have preceded them. I may mention the isolation of the active constituents of drugs on which so much admirable work has been done by the late Professor Bourquelot and by Dr. Power and Dr. Henry; on the drugs and other useful plants of the (French) colonies by Professor Perrot; on the chemical assay of drugs by Farr and Wright; on the botanical identification by that unrivalled master of the subject, E. M. Holmes; on the localization of the active constituents by Professor Goris. Much, indeed, has been accomplished by these eminent men, all of them pharmacists, but much more remains to be done.

An Experimental Station for Pharmacognosy.

For example, further researches on the influence of selection, breeding and manuring in increasing the amount of active constituents in plants are urgently required. In this respect it is unfortunate that no experimental station exists in this country in connection with the Pharmaceutical Society. I mean such a station as the Wisconsin Pharmaceutical Station. This station is a co-operative enterprise between the office of Drug Plant and Poisonous Plant Investigation of the Bureau of Plant Industry of the United States and the Pharmaceutical Experiment Station of the Department of Pharmacy of the University of Wisconsin. Its establishment was endorsed in 1917 by the National Association of Retail Druggists, which resolved:

"That this Association go on record in favor of the establishment of a pharmaceutical experiment station in every State of the Union and the support, in part at least, of such stations by the Federal Government for the benefit of pharmacy in general and the highly important vegetable materia medica in particular."

The station receives a contribution of $5,000 a year from the Federal Government. It is aided by contributions from various pharmaceutical firms interested in the work, and, in conformity with a resolution adopted by the Alumni of the University of Wisconisn, has established a research fund. When discussing the introduction of the bill to establish the station, the Alumni stated in their resolution that "appreciating that the professional standing of the pharmacist depends as largely upon the advancement of the science and art of pharmacy as upon the services which he renders more directly to society, the pharmaceutical Alumni of the University of Wisconsin have decided to raise a research fund to be administered by the Board of Regents."

Such a station, of however modest a nature, would be invaluable as an aid to the furtherance of scientific pharmacognosy in this country, and there would seem to be no insuperable difficulty to its establishment, if not as an independent station, possibly as an adjunct to one of the agricultural institutes. At present the research laboratories of the Pharmaceutical Society, which, as I have said, should be the headquarters of all information respecting drugs, have no place where the material necessary for their work can be grown, but have to depend upon the assistance—always, be it said, most willingly

given—of the Director of Kew Gardens and of the Curator of the Chelsea Physic Garden. The financial position of the Society, as shown by its balance sheet, is sound. Is it not obvious that the small expenditure necessary for extra facilities in this direction would not only further the Society's scientific work, but would also raise its position in the eyes of every learned society and educational body in the kingdom? Such expenditures would be perfectly legitimate and in harmony with the objects for which the Society was founded and with the policy pursued during the greater part of its life.

The Field for Investigation.

As further subjects on which investigation is required, I may mention the part played by alkaloids in the metabolism of the plant. At present the opinion is gaining ground that alkaloids form a means by which plants dispose of the excess nitrogen resulting from the breaking down of complex nitrogenous substances. Until more light is thrown on this it is difficult to see how rational experiments can be conducted to induce or compel the plant to produce larger quantities of such alkaloids. While the synthetic production of quinine, for example, would undoubtedly be a triumph for organic chemistry, the more economical method of production may well lie in the proper utilization of the countless millions of natural laboratories that every plant possesses in the cells of which its tissues are composed.

So vast in extent and so widely distributed are the British Dominions that they must contain an untold wealth of plants, some of which may well be superior for medicinal, dietetic, or technical purposes to those now generally employed. The Committee of Scientific and Industrial Research, well aware of this, has appointed a Forestry Research Board, of which Sir David Prain is the Director, and the Board has appointed a sub-committee which is charged with investigations of this nature, and which a pharmacognosist has been invited to assist by his expert knowledge of medicinal plants.

Many drugs reach the Society's research laboratories and museum of which the botanical sources are quite unknown. A means of determining these, or arriving at some approximation to them, based on the anatomical or other characters, would be extremely useful; here there is unlimited opportunity for useful investigation and tabulation.

That this country is, in one respect at least, in a peculiarly for-

tunate position was recognized many years ago by Jonathan Pereira, who, when appealing to the Council of the Society to appoint a Scientific Committee for the Promotion of Pharmacological Knowledge, said, with reference to the problems in materia that still remain to be solved, that:

"No country in the world possesses so many facilities for carrying on inquiries such as those to which I here allude as Great Britain. Her numerous and important colonies in all parts of the world, and her extensive commercial relations, particularly fit her for taking the lead in investigations of this kind. Moreover, she is peculiarly interested in such inquiries. From her extensive possessions in different parts of the world we draw a very large portion of the substances now used in medicine. By the establishment of a Committee on Pharmacology in the mother country an opportunity would be obtained of bringing into notice the various medicinal substances produced in the different portions of this great Empire. In this way substances now unknown to us or little employed by us might be brought into use, and in some instances, perhaps, the produce of our own colonies might be advantageously substituted for that of other countries. Furthermore, in those cases in which British products are inferior to those of other countries, this committee might be able to ascertain the causes of the inferiority and suggest the means of removing them. In these and other ways, then, I apprehend that such a committee would prove useful in a commercial as well as a scientific point of view."

University Degrees for Pharmacists.

The University of Manchester, in 1904, included Pharmaceutics in the list of subjects which may be presented for a degree in Science. Pharmaceutical students who wish to take this degree must have passed the Matriculation examination or its equivalent. They then attend courses in Chemistry, Physics, Botany, and Pharmacy, and present themselves for the Intermediate examination in the first three subjects at the end of the first year. During the second year they attend courses in Advanced Chemistry, Advanced Botany, and Pharmaceutics; during the third year further approved courses in Chemistry *or* Botany, and in Advanced Pharmaceutics; they also have to attend an approved course in an Arts subject, preferably French or German. The subjects they present for the Final are (1) either Chemistry, and (2) Pharmaceutics. Pharmaceutics include (1) General Materia Medica, Chemical, Vegetable and Animal; (2) Pharmacy and Pharmacy Law; (3) one of the following groups of drugs

treated more fully, *viz.*, (*a*) Synthetic Remedies; (*b*) Alkaloids and Glucosides; (c) Volatile Oils and Resins; (4) Laboratory Work, including Pharmaceutical Chemistry, Pharmacognosy, and Practical Pharmacy. This includes the chemical, general, and microscopical examination of drugs, their commercial varieties, substitutions, and adulterations, including assaying, the isolation of active principles, and exercises in pharmacopœial preparations.

In the University of Glasgow the candidate for the degree of B. Sc. in Pharmacy must follow a course analogous to that prescribed by the University of Manchester. It will be unnecessary for me to enter into detail beyond pointing out that the chief difficulty lies in the subjects required for the Final examination. These are Chemistry, Botany, Materia and Pharmacy.

Three years ago Miss Buchanan, at a meeting of the Council of the Society, moved: "That it be referred to the Library, Museum, School, and House Committee to approach the appropriate authorities with a view to the establishment of a degree in Pharmacy of the University of London," and earnestly commended to the attention of the Committee the desirability of giving special thought to the proposal for the erection of a College of Pharmacy which would be recognized by the University. This resolution was adopted, and the time is now opportune for making a determined effort to induce the University of London to follow the example of Manchester and Glasgow and offer facilities and inducement for our students to proceed through the degree of Bachelor of Science to that of Doctor of Philosophy, and possibly of Doctor of Science. There is no doubt that advantage would be taken of such facilities. More of the entrants into pharmacy would matriculate at the University; more of them would take a degree in Science, and some, certainly those who aspired to teach pharmacognosy, would proceed to the degree of Doctor of Philosophy.

The immediate objects that the great men who founded the Pharmaceutical Society had in view are known by heart to every pharmacist. The energy they put into their work was such that within thirteen months of the foundation of the Society the School of Pharmacy was established, and within three years the first public chemical laboratory in this country was opened. Is not this a record of which any Society might be proud? And what was the effect of this policy on the estimation in which the Society was held? The Committee for the Promotion of Pharmacological Knowledge to which

I have alluded consisted of fourteen members of Council, together with fourteen honorary members and other scientific men, of whom no fewer than eleven were Fellows of the Royal Society. Does not this fact speak for itself? And if you wish confirmation of the character of the leaders of the Society, read the Journal published by the Society while still in its infancy, and by the solidity of the information and the dignity of the style judge of the calibre of the men under whose guidance it was published. Yet their good work was checked by the rank and file, who, by insisting on a reduction of the subscription from £2 2s. to £1 1s., and so refusing to contribute three farthings a day, cut down the supplies of a Society that had to form and maintain a library and museum and support a school! What would not the position of the Society be today had it not been for that short-sighted policy?

The Renaissance of Pharmacy.

For many years the Council continued its endeavors to raise the Society to the rank of a learned body, and so acquire the influence that it should be in a position to exercise, but of recent years this policy has receded into the background. There is, however, at the moment distinct evidence of the determination of the Society to foster its scientific work more in the future than it has done in the immediate past, and I regard this as one of the most hopeful signs for the future of pharmacy. By developing the work that is our own—that is, the natural history and chemistry of drugs, either through botany and pharmacognosy on the one hand, or through chemistry and pharmaceutical chemistry on the other—we shall establish our position as a learned Society. The way is through the schools of pharmacy and through the research laboratories, which are a necessary, and should be a compulsory, complement of every school of pharmacy; teachers who have been properly trained and who are imbued with the proper spirit may be trusted to follow it.

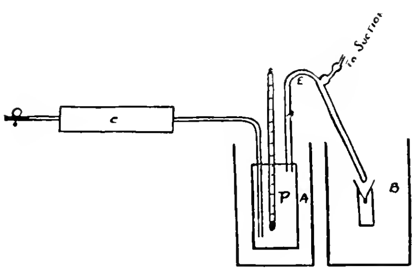
I am convinced that the future progress of pharmacy as an honored art and profession depends upon the development of pharmacognosy and pharmaceutical chemistry and specialized sciences. I have devoted my remarks to pharmacognosy, and I trust I have clearly outlined the main principle underlying them and justified its soundness. There may be obstacles to be surmounted, misunderstandings to be dispelled, and prejudices to be overcome, but the spirit of the pioneers of scientific pharmacy exists today in the great

pharmaceutical community of this country. Though latent, it is strong, and awaits only time and circumstance to become again the animating factor in the counsels of our craft. May the Pharmaceutical Society, mindful of its splendid traditions, apply its energies in the sphere that is its own, set its educational policy steadfastly in the direction indicated by the wisdom of its founders, relight the lamp of enthusiasm, and foster the love of the calling which distinguished its early years. So alone can pharmacy ensure for itself the appreciation of a nation.

DETERMINATION OF SOLUBILITY.*

By G. W. Walker.

The author had occasion to determine the solubilities of various solids in water at different temperatures. The usual method of forming a saturated solution then filtering off a portion was found to be unsatisfactory on account of loss of temperature during manipulation. The difficulty is obviated by use of the apparatus as in sketch.



The beaker A contains water or other suitable liquid in which the flask containing the solid and solvent is held. B is an air-bath containing the filter and weighing bottle. C is a combustion tube containing potassium hydroxide to eliminate CO_2 from the air. Hot air is drawn through the apparatus, and serves to keep the solid in agitation. When the requisite temperature has been reached, the leading tube E is inserted into the saturated solution and suction gently applied. Some of the contents of F are then filtered off and at the required temperature. Of course the air-bath is kept at the necessary temperature.

Careful manipulation will give satisfactory results over a range of temperatures.

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THE ANESTHETIC PROPERTIES OF PURE ETHER.*†

By Raymond L. Stehle, M. A., Ph. D., and Wesley Bourne, M. D., C. M., Montreal.

At least twice within the last few years it has been reported that pure ethyl ether is not an anesthetic, and that the physiologic action ordinarily attributed to this compound is due to impurities contained in the commercial material. According to Cotton,[1] carbon dioxide may be the active agent in some ethers; but this investigator reported that he had obtained the best results by the use of ether containing ethylene and possibly another gas of unrecognized nature. According to Wallis and Hewer,[2] ketones are the most important impurities, though they state that the anesthetic action of ether is enhanced by treating it with carbon dioxid and ethylene. The lack of chemical details in the papers of Cotton and of Wallis and Hewer is unsatisfactory.

The foregoing statements appeared to warrant further investigation. All commercial ether today is manufactured by the Williamson sulphuric acid-alcohol process. The reaction is such that side reactions may occur, the products of which may contaminate the main product and therefore lend some degree of plausibility to the claims mentioned. A different method of preparing ether, therefore, was adopted. Instead of the sulphuric acid process, a general reaction well known to organic chemists was employed. It consisted in bringing sodium ethylate and ethyl iodid together in alcoholic solution, whereupon the following reaction occurs:

$$C_2H_5ONa + C_2H_5I = C_2H_5OC_2H_5 + NaI$$

The sodium iodid precipitates and the ether is separated from the alcohol by fractional distillation. The possibility of side reactions occurring is not obvious, and the product may be assumed to be quite pure. *A priori*, the possibility of contamination with aldehyds and ketones is practically eliminated because, in preparing the sodium

*From the Laboratory of Pharmacology, McGill University. The expenses of this investigation were borne in part by the James Cooper Endowment.

†Reprinted from *Jour. Amer. Med. Asso.*, 1922, 79:5:375.

[1] Cotton, J. H.: *Canadian M. A. J.*, 7:769 (Sept.), 1917.

[2] Wallis, R. L. M., and Hewer, C. L.: *Lancet*, 1:1173 (June 4), 1921.

ethylate, the hydrogen generated when the metal was dissolved in the alcohol would have reduced any aldehyds and ketones present to alcohols. In order to serve as a check, however, the ether obtained was analyzed quantitatively for ethylene, while qualitative tests for aldehyds and ketones were performed.

For the ethylene test, 2 cc. of the ether in question was dissolved in tetrachlormethane, and 10 cc. of an approximately third-normal bromin solution was added. The mixture, in a stoppered bottle, was placed in the dark for eighteen hours to give opportunity for any ethylene present to absorb bromin. At the end of the reaction, the residual bromin was determined by titrating the mixture with a standard thiosulphate solution. Assuming that all of the bromin not recovered was taken up by ethylene, the maximum amount which could have been present in the ether was 0.04 per cent. It is likely that the amount was smaller than this, since some or all of the bromin may not have been taken up by ethylene, but may have substituted for hydrogen in the ether. Schiff's test for aldehyds (restoration of red color to fuchsin solution decolorized with sulphur dioxid) was negative, as was the nitroprussid test for acetone and for methyl ketones in general. Other ketones than the methyl ketones do not give the nitroprussid reaction, but all of them are excluded because of their high boiling points (the simplest, diethyl ketone, boils at 103 C). They would have been eliminated in the fractionation process.

A small amount of ethyl iodid was present in the ether. This was evident after exposing the product to bright sunlight for a few days, which cause it to take on a light amber color because of the liberation of iodin.

Being satisfied that the ether prepared was suitable to decide the question at issue, we subjected its anesthetic properties to experiment. An albino rat was the first object on which its action was tried. When placed in a jar together with 1 cc. of the ether, the animal became anesthetized almost immediately, and on removal from the jar recovered quite as fast as it had succumbed. The remainder of the small quantity which was obtained in the preliminary trying out of the method of preparation was administered to a female patient weighing 245 pounds (111 kg.) and being operated on for a large ventral hernia. Induction took place in four minutes, that is, anesthesia was brought to the first stratum of the third stage. This

depth was maintained there ten minutes when, as we had no more of the material, a change was made to one of the commercial ethers.

A larger quantity of the ether was then prepared (about 1½ pounds), and this was used in five additional cases which were chosen miscellaneously. In none of them was there any preliminary alkaloidal medication, such as the administration of morphin and atropin. The McGill modification of the Ferguson mask was used. All five patients expressed comfort during the induction period, which lasted from four to six minutes, and which was marked (except for a quite negligible amount of vomiting of food in Case 4 just before the start of the operation) by the absence of any signs of irritation, such as lacrimation, salivation, mucous formation, holding of the breath, coughing or struggling. The whole period of anesthesia was uneventful in each instance and entirely satisfactory to the surgeon conducting the operation. Recovery was immediate or early, and nausea and vomiting were minimal, even though gastric lavage was done only in the case of Patient 4. Worthy of mention is Case 6, in which good analgesia was obtained intermittently for each pain over a period of forty minutes of normal labor.

Conclusions.

Pure ether, made by a clean-cut chemical reaction which excludes almost completely any contamination with substances which have been claimed to be the real anesthetic agents of ordinary ether, possesses to the highest degree the anesthetic properties which have usually been attributed to it.

VITAMIN THEORIES.*

The essential experimental facts about the functions of the best known vitamins have become sufficiently familiar to justify the belief that these newly recognized food factors furnish something of importance in a human diet. Holt [1] recently summarized the service which the newer knowledge has rendered by pointing out how it

*Reprinted from *Jour. Amer. Med. Asso.*, 1922, 79:5:*381*.

[1] Holt, L. E.: "The Practical Application of the Results of Vitamin Studies." *J. A. M. A.*, *79*:129 (July 8), 1922.

has helped to place the whole subject of nutrition on a better scientific basis. The experimental has been substituted for the empiric method in determining the value of the different foods. Formerly we might know that certain foods were desirable and necessary; now we are often able to say why such is the case and to determine their precise value in nutrition.

The study of vitamins has helped to make clearer why a variety of foods is so essential to well being, and how danger may follow when diet becomes restricted from either necessity or caprice. Decrying the indiscriminate use of alleged vitamin-bearing preparations as popular therapeutic agents, Holt further utters the warning that until they have been confirmed by adequate clinical experience there is some danger in relying too much on the results of laboratory observations on animals of a different species whose physiologic needs may be different from those of human beings. In a somewhat similar strain, Mitchell [2] has asserted that in the total lack of quantitative data on the vitamin requirement of man, and in the general absence of malnutrition or disease among people in this country which can with any degree of probability be diagnosed as involving vitamin deficencies, it seems premature to formulate recommendations for the balancing of diets with respect to vitamins. It is pointed out that the classic experiments are conducted in each instance on species peculiarly susceptible to the particular deficiency under investigation. However, this sort of criticism is a conventional one in medicine. While admitting the background of truth in it, we must recall that the clues furnished by animal experimentation have led to so many helpful avenues of information that it would be scientific folly to fail to heed them, even in our as yet inadequate understanding of the possible bearing of vitamins on human welfare. There is no necessary conflict between an open mind and conservatism in scientific judgment. Hence we are glad to reiterate the warning of Mitchell, when he writes:

"At a time when popular periodicals are widely publishing irresponsible articles on vitamins, ignorantly or deliberately creating an entirely distorted popular conception of them, and when commercial concerns are widely advertising purely hypothetical advantages of

[2] Mitchell, H. H.: "The Necessity of Balancing Dietaries with Respect to Vitamines." *Science*, 56:34 (July 14), 1922.

vitamin preparations, it is particularly important that investigators in nutrition exert great care in the wording of statements as to the practical significance of vitamins in every day life. Otherwise they may become unwilling accomplices in the perpetration of a gigantic fraud upon the American public."

It is in harmony with such conservatism of statement, we believe, that the recent report of the Council on Pharmacy and Chemistry of the American Medical Association on yeast preparations has been formulated.[3]

With so much uncertainty still admitted it might seem futile to discuss at this time the theories of the mode of action of vitamins. However, the history of science attests that its development has more often been promoted rather than retarded by the leavening influence of hypotheses. Most investigators of the vitamins have looked on them as functioning somewhat as hormones are supposed to act in the organism, namely, as stimulants to certain physiologic mechanisms. Others have imagined the newly discovered factors to be essential components of some, at least, of the living tissues; thus they would be quite as indispensable as are other structural units of the body, such as certain amino-acid groups, calcium, phosporus or iron. A further group of students has assumed the vitamins to be primarily catalytic in function, thus behaving like the well known enzymes. Hess,[4] of Zurich, has lately offered somewhat indirect evidence that the antineuritic vitamin, which relieves the symptoms of poly-neuritis in animals fed on diets devoid of vitamin B, contributes in some way to the production of oxidative enzymes in the body. Studies in vitro on the tissues of polyneuritic pigeons indicated to him a decrease in the oxidative enzymes usually found in well nourished animals. On this hypothesis the avitaminosis is an expression of poverty of the cells in the factors that facilitate tissue respiration. This is one of the many guesses which the future will need to evaluate in the physiology of vitamins.

[3] Yeast Preparations, New and Nonofficial Remedies. *J. A. M. A.*, *79*:135 (July 8) 1922.

[4] Hess, W. R.: Die Rolle der Vitamine im Zellchemismus. *Ztschr. f. physiol. Chem.* *107*: 284 (Dec. 21) 1921.

SCIENTIFIC AND TECHNICAL ABSTRACTS

Simple Test for Sugar.—A simple test for the detection of sugar in urine is given by J. Livingston (*B. M. J.*, May 6, 1922, p. 719), who points out that a drop of urine containing sugar evaporated on a microscope slide over the flame of a spirit lamp leaves a "tacky" glistening film of syrup. Further heating turns this film a rich golden color. Full heating converts the deposit into burnt sugar or caramel. Urine containing 14 grains to the ounce, according to fermentation test, gave the reaction after dilution with five times its volume of water.

Treatment of Poison Oak Dermatitis.—The author uses an alcoholic solution of the toxin of the poison oak plant (*Rhus diversilobia*) for this purpose. A given weight of the fresh crushed leaves of the plant is covered with absolute alcohol, extracted, filtered, and precipitated, and the precipitate dried at a low temperature. A given weight of the toxin is dissolved in absolute alcohol and sterilized water added. An arbitrary standard is set for the weight of the toxin, volume of absolute alcohol, and the volume of sterile water. Of the several hundred patients injected, only a few have felt faint or nauseated, but this was shown to be due chiefly to psychological factors. Though not invariably successful, the results obtained are superior to those seen after any other form of treatment. From 0.5 to 1.5 cc. is given intraglutealiy, and the dose is repeated in twenty-four hours, and again twenty-four hours later if improvement is not very definite. Usually within forty-eight hours there is great improvement, and it is seldom that a third injection is found necessary. At the same time, the following solution is given by mouth until finished:—Oak toxin solution, 4 gms.; aromatic elixir, 90 cc. The dose is 10 drops in water thrice daily, increasng by one drop each dose until 20 drops are being taken. Then one teaspoonful is given once daily. By this method tolerance for the poison may be established, and it is recommended that this solution be taken once a year.—(H. E. Alderson, through *Journ. Amer. Med. Assoc.*, June 17, 1922.)

Fish-liver Oils as Sources of Vitamin A—The exceptionally high content of vitamin A in some liver oils has already been pointed out, and the authors have drawn attention to the fact that this high potency was not only characteristic of cod-liver oil, but that it was also shared by oils from the livers of other fishes, such as the coal-fish and the haddock. They find a very marked variation in the vitamin potency of different liver oils, and they point out that although this variation in potency may be sixteen-fold, the least potent oil they have examined has proved to be more active than any other substance containing vitamin A, and this very high vitamin content is found to be characteristic of fish-liver oils in general. The method of preparation is not responsible for the variation, and it is therefore concluded that some physiological cause, such as variation in the food or in the sexual condition of the fish may influence the potency of the oil. They draw attention to an important fact, namely, the very high potency of the soft and hard roe of the cod, which are a rich source for vitamin A, and they maintain that in the roe we have a very palatable article of food very rich in the vitamin, and it should therefore be valued for this quality. Besides the liver oils mentioned, they find very great activity, also, in the liver oils of the ling, skate, shark, plaice, and pollock, so that the high vitamin content is not confined to the liver oils of the gadoids. The potency of these oils is of the same order as that of cod-liver oil, and of the liver oils so far examined the highest activity is found in coal-fish liver oil and the lowest in haddock liver oil. The high vitamin A content is not only characteristic of Norwegian oils. Specially prepared oils of British origin are of a similarly high potency. Several samples of Newfoundland cod-liver oils were found to be as potent as the most active Norwegian oils.—(S. S. Zilva, D. Sc., and J. C. Drummond, D. Sc., *Lancet,* June 24, 1922, 1243.) Through the *Pharm. Journ. and Pharm.*

Determination of Caffeine in Tea.—A study of the methods of determining caffeine in tea has been conducted by the Association of Official Agricultural Chemists, including also a modified method which is much shorter than those heretofore in vogue. The results are set forth in some detail in the twenty-sixth annual report of the Connecticut Agricultural Experiment Station. The modified procedure, which is found to give good results, is as follows:

To 5 grams of the finely powdered material in a 500 cc. flask, add 10 grams of heavy magnesium oxide and 200 cc. of water, and boil gently over a low flame for two hours, using a small-bore glass tube about 80 cm. long as a condenser. Cool, dilute to 500 cc. and pass through a dry filter. Take 300 cc. of the filtrate, equivalent to 3 grams of the material, introduce into an Erlenmeyer flask, add 10 cc. of a 10 per cent. dilute sulphuric acid and boil until the volume is reduced to about 100 cc. Filter into a separatory funnel, washing the flask with small portions of 1 per cent. sulphuric acid, and shake out six times with chloroform, using successively portions of 25, 20, 15, 10, 10, 10 cc. each. Add to the combined extracts 5 cc. of 1 per cent. potassium hydroxide. When the liquids have completely separated, draw off the chloroform layer into a suitable vessel, wash the alkaline solution with two portions of 10 cc. each of chloroform, add these washings to the main bulk, transfer to a tared flask, evaporate to dryness, finishing by drying in the water over at 100° C. to constant weight. If desired, the residue may be treated by the Kjeldahl method to determine nitrogen, calculating the caffeine by the factor 3.464. The heavy magnesium oxide should meet U. S. P. requirements.

The results calculated from nitrogen determinations have not been wholly satisfactory.

H. L.

MEDICAL AND PHARMACEUTICAL NOTES

Drug Adulteration in Connecticut.—The twenty-sixth annual report of the Connecticut Agricultural Station, recently issued, covering the work for the year 1921, gives many data in regard to both standard and proprietary preparations.

A sample of an elixir sold for general laxative and anthelmintic uses contained nearly 8 per cent. of alcohol, with spigelia, emodin-bearing drugs and aloes. A non-advertised preparation offered as a cure for tuberculosis and claimed by a user to have actually made a cure, was found to be a syrup containing alcohol, chloroform and vegetable extractives. Twenty-four samples of Bay Rum were tested. Many were short in alcohol, but no methanol was detected. Most

of the official preparations tested were found to be correct. Eighteen samples of chlorinated lime were tested; all were under strength, some very deficient. Much of this defect, however, may be due to decomposition after packing. Witch-hazel water samples did not contain any methanol.

A sample, claimed to be pure Spanish olive oil, was submitted to the department by the H. J. Heinz Co., because it responded to the tests for sesame oil as usually applied. This was confirmed when the Baudouin and Villavecchia tests were used on the oil, but when applied to the liquid fatty acids no appreciable reactions were observed. This shows the necessity of checking tests on the oil by tests on the liquid acids. In this connection it may be noted that heated or hydrogenated cottonseed oil does not respond to Halphen's test.

Many examinations were made of diabetic, special and miscellaneous foods. As might be expected, samples were found that claimed to be starchless but were not so. One sample so labelled was found to contain about 70 per cent. of available carbohydrate, most of which was cassava starch. Another sample recommended especially for diabetic patients contained about 50 per cent. of starch and soluble reducing sugars.

Kaffee Hag was tested and found to contain 0.09 per cent. of caffeine. Of four samples of cider, three contained respectively 5.75 per cent, 5.93 per cent. and 4.16 per cent. of alcohol. The other sample contained only a trace, and no preservative was detected.

H. L.

The Oldest Tree in the Americas.—Mexico's largest tree, the venerable cypress in the churchyard at Tule, which foresters say was standing 1,000 years before Columbus discovered America, is beginning to show the weight of years.

The giant tree is a *Taxodium distichum* and its Aztec name is "ahuehuetl." It was so well grown 400 years ago that it sheltered under its generous spread of branches Hernando Cortez and his followers on their ill-fated expedition to Honduras, and was at that time a source of astonishment to those hardy and hardened conquistadores.

Today it is about 160 feet high and four feet from the ground its trunk is 160 feet in circumference. Its branches have a spread of 140 feet.

Recently the great trunk has shown signs of splitting. Reports from the State of Oaxaca, to which many tourists have gone in years past for a sight of the "great tree of Tule," are that age is at last putting its mark on this representative of the forest family commercial lumber interests have exploited as "the wood eternal."

In size is resembles the great Banyan (*Ficus Indica*) in the botanical garden at Calcutta and the Chestnut Tree of One Hundred Horses, said to be the largest tree in the world, at the foot of Mt. Etna.

Baron von Humboldt was so impressed by the gigantic proportions of this great savin, which he considered a worthy rival of the huge baobab (*Adansonia digitata*) of Africa, believed to be the oldest organic monument on the globe, that he inscribed his name on the trunk, an inscription now nearly overgrown by the bark.

De Calvino, E. M.—"Los Pelos Urentes de la Pica Pica" ("The Stinging Hairs of Mucuna Pruriens"), Revista Medica Cubana 33: 1-16, 6 fig., 1922.—Author first describes the aerial portion of *Mucuna pruriens* as found in Cuba, Porto Rico and the other Antilles. The microscopical characteristics and constituents of the stinging hairs are then taken up, after which a comparison is made between the hairs of *Stizolobium capitatum* (Velvet Bean), and *Mucuna pruriens*. The article concludes with the therapeutic properties, constituents of the seeds and treatment of the itch produced by the hairs. Author states that the hairs of the fruit of *Stizolobium capitatum* differ from those of *Mucuna pruriens* by the absence of hooks and mineral incrustations in the cuticular membrane.

H. W. Y.

NEWS ITEMS AND PERSONAL NOTES

Professor Bougault Succeeds Professor Emile Bouquelot.—Professor Bougault, who was recently elected an honorary member of the Philadelphia College of Pharmacy and Science, has occupied the chair of Galenical Pharmacy at the Paris Faculty of Pharmacy since it was left vacant last year by the death of Bourque-

lot. As a matter of fact, he is the pupil of Bourquelot as well as his successor. When young Bougault passed his qualifying examination as "interne" (hospital house pharmacist) in 1893 he was allotted to the Laennec Hospital—the old building near the "Bon Marché" familiar to all lady shoppers in Paris—where Bourquelot was so long head pharmacist. The old laboratory there has produced some well-known scientists, and the "interne" found himself in such congenial surroundings that when he took his diploma he decided not to start in business, but to continue his researches. He became a preparator at the Paris Superior School of Pharmacy (as the faculty was then termed), worked under Professor Villiers, and finally, in 1909, became an assistant professor. Meanwhile he had successfully passed the examinations qualifying him for the post of head-pharmacist in a Parisian hospital and held that position first at the Hospital Herold, subsequently at Trousseau, and finally at the Tenon Hospital. His scientific researches have principally been in organic chemistry, and for these he was awarded the Gobley prize in 1901, the Jecker prize of the French Academy of Sciences in 1910, and the Berthelot medal in the same year. He was elected a member of the Paris Society of Pharmacy in 1903, and was chosen as its president in 1921. He belongs to the editorial staff of the *Journal de Pharmacie et de Chemie,* and reviewed in this periodical the United States Pharmacopœia in 1906 and the British Pharmacopœia in 1898.

Dr. Whelpley Resigns as Secretary of the Missouri Pharmaceutical Association.—Dr. Henry M. Whelpley, after thirty consecutive years of service as permanent secretary of the Missouri Pharmaceutical Association, insisted on the organization finding a successor. Professor D. V. Whitney, of Kansas City, finally consented to take up the work for the ensuing year.

A Sept-Centennial.—The Philadelphia College of Pharmacy and Science has just celebrated its hundredth anniversary and Philadelphia City is preparing to celebrate the hundred and fiftieth anniversary of the founding of our nation. Both celebrants feel somewhat old, but they are infants in comparison with the University of Padua, which last May celebrated its seventh centennial. Many rep-

resentatives were present from various countries, institutions and societies. Memorial volumes were issued and the usual programs carried out.

A. Homer Smith, Secretary Drug Manufacturers' Association.—A. Homer Smith, is the new secretary of the American Drug Manufacturers' Association. He has spent practically his entire commercial life in the drug business. Beginning as a clerk in a retail drug store, he served ten years behind the counter, meanwhile attending the Philadelphia College of Pharmacy and Science, by which he was graduated in 1902 with the degree of Doctor in Pharmacy.

Mr. Smith joined the sales force of H. K. Mulford Co., Philadelphia, about 1905. He remained with that firm fifteen years, becoming, in turn, special representative, assistant sales manager, general sales manager and secretary of the company. In 1920 he became associated with the Nyal Co., Detroit, as a director and general manager. The pharmaceutical side of the industry called him thence after a short time and he joined the organization of E. R. Squibb & Sons, this city, as secretary. During the war Mr. Smith represented the drug trade on the War Service Board at Washington, and he has been a prominent figure in the deliberations of the industry in connection with national questions, legislative and otherwise.

Received by President Harding.—On Friday, June 30, 1922, President Harding received in the White House the Medico and Pharmico Club of Cleveland, Ohio. The delegation was one of the largest that has visited the White House, numbering 120 prominent physicians and pharmacists of Cleveland, as well as members of the graduating class of Western Reserve University College of Pharmacy.

They had travelled in large, sight-seeing auto busses, having left Cleveland via the Lincoln Highway across the Allegheny Mountains, to Gettysburg, where they went over the famous battlefields of Civil War days.

Thence they proceeded to Philadelphia, where their principal objective was a visit to the Pharmaceutical and Biological Laboratories of H. K. Mulford Company. They also viewed the botanical gar-

dens which are being conducted by the H. K. Mulford Company in collaboration with the Philadelphia College of Pharmacy.

From Philadelphia the party proceeded to Baltimore and Washington, where the reception by their fellow Ohioan, President Harding, took place. Following the Presidential reception, there was a special luncheon, where a number of prominent speakers were heard, including Samuel L. Hilton, President of the American Pharmaceutical Association, W. H. Bradbury, Manager of the Washington Wholesale Drug Exchange, and others.

BOOK REVIEWS

An Introduction to the Physics and Chemistry of Colloids. By Emil Hatschek. 4th Edition. 165 pages with 20 illustrations. Price, $2.25. P. Blakiston's Son and Company, Philadelphia.

This is an enlarged and rewritten edition of a book that was originally intended to introduce colloidal chemistry to readers possessed with a reasonable knowledge of physics and chemistry. The twenty-five chapters take up the history of the subject, its development in recent times, the nomenclature, classification of the various phases of the subject, methods of forming colloids and of coagulating them, the theories underlying phenomena of colloids, and a few practical applications. The subject matter is presented in readable style and printed with good type on fair paper. There is much more real meat in the book than the number of pages would lead one to suspect. The size of the volume is such as to make its owner to easily slip it into a coal pocket to be ready for use when he finds a few moments available for reading. As an introduction to colloid chemistry it very satisfactorily fulfills its mission.

F. P. Stroup.

Impurities and Falsifications of Chemicals, Their Determination and recognition. By Dr. R. Strauss, Chemiker. 96 pages. M. Bohlmann Verlag Meissen (Germany).

According to the preface, "this book is mainly written for the manufacturer, trader and consumer in the chemical branch, to acquaint him with the nature of the chemicals passing his hand, to show

how the qualities, falsifications and impurities can be recognized." It is intended to give the non-chemist easy practical methods, with no hint of theoretical argument. Even chemical formulas are omitted.

The book is, doubtless, an attempt to translate a German work into English, the translating being done by one whose knowledge of English was decidedly limited. All through the volume there is evidence that the translator had recourse to an English-German dictionary, the result being that the book is full of ludicrous expressions, as well as mis-translations. Here are a few examples:

On page 4 we read in a description of the manufacture of sulphuric acid, "The right raw-product is the sulphur and its combinations with the heavy metals, the silicates, zinc ores and brilliants, mostly iron silica or pyrite, zinc ore, potters ore and copper silica." On page 36, under tests for impurities in soda we read: "Iron: The solution made sour and potash ferrocyanide produces a blue colouring, if iron is present a green colouring." Again, "Natron Sulphite: When made sour with muriatic acid a strong smell of sulphuric acid appears (if heated)."

Most of the important commercially inorganic chemicals and a few organic compounds are mentioned. The intention of the author was good, but the results, at least as far as the English version is concerned, are anything but satisfactory. The chemist who is familiar with the facts recorded (or purporting to be recorded) on its pages finds difficulty in grasping the meaning of many of the paragraphs, even though he is not unfamiliar with German. What, then, would be the value of the volume to the man for whom it was written, the non-chemist? It is just as well that no price was quoted.

F. P. Stroup.

The firm of Theodor Steinkopff, Dresdin-Blasewitz, the publishers of the world-wide-known Pharmazeutische Zentralhalle, founded in 1859 by that master of pharmacy, Dr. Hermann Hager, have begun the publication of a *Natural Science Series*, edited by Dr. Raphael Ed. Liesegang, of Frankfurt, A. M. The following two volumes have been received for review:

Analytische Chemie. Von Dr. Th. Döring, o. Professor an der Berkademie Freiberg. 8vo., pp. 97. Price 44 cents.

The five parts of the book are arranged as follows: I General;

II, Detection, Quantitative Analysis and Separation of the Cations; III, Detection, Quantitative Analysis and Separation of the Anions; IV, Determination of C, O and gases in metals, especially in iron; V, Elementary Analysis of organic substances. An excellent authors' and subject index conclude the work, which is up-to-date in every respect and which we can highly recommend.

ORGANISCHE CHEMIE. Von Dr. R. Plummerer, Prof. Univ. München. 8vo., pp. 182. Price 96 cents.

The text before us is a condensed, but up-to-date organic chemistry. Dr. Plummerer, an authority on this subject, has arranged the book in an excellent manner in eighteen chapters, from which we will cite the following few: 3, Thermo and Spectro-chemistry and Absorption Spectra; 5, Oxonium Salts; 10, Tritumediates and Colors; 11, Methods of Oxidation and Hydration; 13, Sugar (monoses, bioses, polyoses, glycerin fermentation, amino-sugar and glucosides); 15, Tannins; 16, Enzymes and Hormones; 17, Alkaloids; 17, Hæmoglobin, Chlorophyll and Assimilation of CO_2.

This excellent work should also become better known on this side of the "great pond"!

OTTO RAUBENHEIMER, Ph. M.

DER GRAF CAGLIOSTRO. Die Geschichte eines Mysterienschwindlers zur Warnung für unsere Zeit. (Story of a Charlatan and Fraud as a Warning in Our Time.) Von Heinrich Conrad. 12 mo., pp. 270. Robert Lutz, Stuttgart.

That Count Allessandro Cagliostro, the celebrated alchemist, charlatan, adventurer and fraud, gained the rudiments of his chemical knowledge in an apothecary shop is perhaps not well known. Giuseppe Balsamo, his true name, was born August 8, 1743, in Palermo as the son of poor parents. He entered the order of the Brothers of Mercy and was employed in the pharmacy at the monastery in Palermo. He joined the Greek alchemist, Althotas, thereby gaining further chemical knowledge, and traveled extensively. Cagliostro, the wanderer and adventurer, became the king of all alchemists and fraud of his time, due to the ready credulity of the public,

which had been prepared by such men as Emanuel Swedenborg, the Swedish minister and spiritualist, Franz Mesmer, the Swiss founder of the doctrine of animal magnetism, Johann Joseph Gassner, the Bavarian banisher of the devil, and Count Saint Germain, who was said to have attained an age of 1700 years, due to the species or tea which still bears his name.

These pioneers or forerunners paved the way for the frauds of Cagliostro. He sold his Lotion to produce a beautiful skin, his Egyptian Wine, his Rejuvenating Powder and his Elixir of Life to "make the old young" and to produce that much desired "youthful vigor." He sold formulas for the transmutation of metals and for the preparation of the philosopher's stone and he gave free medical treatment to the sick. Cagliostro was in communication with the "other world" and held spiritual séances and besides that was a clever astrologist. He established an order which he called Egyptian Freemasonry, in which, as Grand Kaphta, he pretended to know the secrets of futurity, and made many dupes among the higher classes.

He maried Lorenza Feliciana, whose beauty, ability and want of principle made her a valuable accomplice to his frauds. Under the name of Princess Santa Croce she became the favorite and mistress of Prince Potemkin, so that the Empress Catherine II paid her and Cagliostro the sum of twenty thousand rubles to leave Russia forever. The couple traveled repeatedly throughout the different countries of Europe and found ready dupes even among the higher classes, as the kings, princes, nobility and clergy.

The book before us is highly interesting and abounds with numerous tales how the charlatan and impostor defrauded the public and how he was witty and prompt enough to avoid detection. When the celebrated Swiss preacher, poet and writer, Lavater, asked Cagliostro the following three questions:

> "From where did you obtain your knowledge?
> "How did you get it?
> "What does it consist of?"

he gave the following laconic reply:

> "In verbis.
> "In herbis.
> "In lapidibus."

In Strassburg, Prof. Horberg, of the University of Upsala, addressed Cagliostro, who pretended to be of Arabian origin, in Arabic, but he was unable to answer him. L'affaire du collier, in the French Court under Queen Marie Antoinette, took place in Paris in 1785, and as a result Cagliostro and Lorenza were imprisoned in the Bastille and were then exiled. Going to England he was attacked by another power, namely the press, which exposed him in such a way that he had to leave the country. On his visit to Rome the Church committed him to the Castle of San Angelo, where on March 21, 1791, he was condemned by a decree of the Pope to imprisonment for life as a freemason, an arch-heretic and a sorcerer. He died in 1795 in San Leone in the Duchy of Urbino. The beautiful Lorenza was committed to a convent.

Cagliostro has been made immortal not only by the present book, but also by the plays and works of Schiller, "Geisterseher"; Göethe, "Gross Kophta"; Dumas pére, "Mémoirs d'un Médecin," and Carlyle, "Cagliostro and the Diamond Necklace."

The book before us is well suited for the library of pharmacists who take an interest in their profession, especially in the historical side.

Otto Raubenheimer, Ph. M.

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EDITORIAL

THE MASTER FORMULA—HONOR, INTEGRITY AND TRUSTWORTHINESS.

Professor Remington delighted in relating to his classes anecdotes concerning his experiences in the Squibb Laboratories, and his close acquaintance with the venerable Dr. Squibb gave him unusual opportunities to appreciate and record that great man's love of truth and honest practice. A reminder of one of Professor Remington's characteristic and inspirational talks came to us recently while reading a booklet issued by the House that Squibb Built. The little paragraph ran something like this:

During the Civil War a certain material used in making one of the Squibb products became very scarce and its price extremely high. One of the young chemists employed in the laboratory suggested to Dr. Squibb that another ingredient be substituted—one which cost less and was easier to obtain, but was not quite so satisfactory. "By changing your formula in this way," the young man argued, "you will save money and most people will never know the difference."

"Young man," said Dr. Squibb, "I am always willing to change a formula when I can improve it. But please remember that—THE MASTER FORMULA OF EVERY WORTHY BUSINESS IS HONOR, INTEGRITY AND TRUSTWORTHINESS. THAT IS ONE FORMULA I CANNOT CHANGE."

Dr. Squibb had sensed aright the message of the unchanging formula. For it was according to its prescription that he compounded the great business concern bearing the mark of Squibb, which long after the passing away of its sponsor continues to draw sustenance and luster out of every letter of his illustrious name. He knew well the inalterableness of the Master Formula—knew well that not even

Time, that insufferable changer of all things material—could ever substitute another for any of the priceless ingredients in this Master Formula, the universal code of ethics.

At random intervals in History, and out of queer, scattered corners of the earth, exponents of the Master Formula have come to Man to describe and prescribe its priceless ingredients. Confucius, of Shantung, the Sage of China; Buddha the Silent, the god of Dark India; Mohammed, Lord of Islam, Soldier and Saviour (?) too; and Jesus of Nazareth, Prince of God, who taught that the Master Formula was the Master's Formula too. All have told the same old story—the story of this recipe for human happiness. The Master Formula indeed has had many great interpreters, and the world would be a better place to live in if its people could properly grasp their interpretations.

And oh! for a keener appreciation today—this today of so much insincere dealing, this today of unfinished tasks, this today of questionable business practices. Oh, for a real understanding of the infallibility of this prescription; of the certainty of the finished product,—this Master Formula—conceived in the depths of Ago and destined to proclaim the obligations of man to his kind as long as the Universe rolls on within its steady system.

HONOR, INTEGRITY and TRUSTWORTHINESS, they are the Priceless Ingredients. And no one can deny the harmony of these constituents—they are compatible to every extreme and out of their ultimate fusion in the crucible of life inevitably comes the crystal clear solution, the quintessence of human desires—the true God-given Happiness.

I. G.

THE ROMANCE OF PHOSPHORUS.

Tax Collector Bauduin had much spare time on his hands, for the thrifty citizens of the little community of Grossenhayn, in Saxony, paid their tax bills promptly and thereby avoided a penalty. Much of this spare time was spent in earnest gossip in the shoemending shop of one Freuben, an eccentric cobbler who had a local reputation as a dabbler in the dark art of alchemy.

One can surmise, then, of the visionary schemes which this peculiar pair indulged in. These were the days when the search for the Quintessence used up the Alchemists' time and efforts. Four

elements they already had, namely earth, fire, water and air, and the fifth—the quintessence, still remained. Freuben, over his last, discussed with the idling Bauduin the possibility of obtaining this fifth essence by combining together the four known essences in an alembic, and then distilling. Thus they conceived that they could obtain the spirit of the world (*spiritus mundi*).

Calx they dissolved in spirit of nitre, the resulting solution they evaporated to dryness, and the residue exposed to air so that it might absorb "humidity." A second distillation was resorted to, and thus was obtained in pure form the long-sought-for quintessence—the virile, potent "humidity."

To prove that "seasons change but human passions never," they placed on sale as a panacea for all human ills, their "captured humidity" at a price of 12 *groschen* per *loth* (approximately sixty cents per ounce) and afflicted rich man and beggar man eagerly came to buy. The alchemists became rich—they had indeed found the philosopher's stone—the *spiritus mundi.*

Freuben threw away his last and purchased a decadent villa and spent his *spiritus mundi* in its reconstruction. Bauduin did not come up for re-election for the first time in many years, and a new tax collector was duly installed in office. Instead he cultivated music and also continued experimenting. One night during the course of his experiments Bauduin dropped and broke a cumbersome lambik containing some of the calcined nitrate of lime, and was surprised to find it luminous in the dark. He also observed that this luminosity came after exposure of this material to sunlight. He promptly recognized the importance of his discovery, and taking some of the "inspired earth" to Dresden City he found Kunckel, a royal pharmacist of that city very eager and anxious to learn all about the queer substance.

The ethics of those days seemed to be almost as flexible as they are today, for history tells us that Kunckel promptly visited with Bauduin so that he might extract from the "ignorant dabbler" the formula for his essence. But Bauduin was wary, and when the visitor spoke of essences and retorts, Bauduin extravagantly discussed cadences and rhapsodies. Finally under some pretext or another, Kunckel induced the alchemist to leave the room for a few minutes, and during this interval the royal pharmacist managed to purloin a fragment of the precious "inspired earth" by nipping it with his finger nail.

Thus it was that Kunckel managed to get material and information with the aid of which he worked out a process of preparing the luminous earth, which Bauduin very discreetly had called Phosphor. Incidentally it is told that when he eventually did produce some of this material, he courteously sent a little morsel of it to Herr Bauduin as a slight memento of the instructive and interesting musical evening that the alchemist had given him.

Later the ethical Kunckel found that another alchemist had "gone one better," and had produced not "inspired earth" but the very "inspiration" itself—the real *phosphor*. Brandt, of Hamburg, an old physician-alchemist, had indeed produced from human urine the element itself, and Kunckel anxiously sought to obtain an interview with the old gentleman, probably expecting to repeat his light-fingered experiment. However he confided the news to a friend bearing the fitting name of Kraft, and the latter immediately justified his name by taking a special post to Hamburg and purchasing outright from Brandt, the secret art and mystery of preparing phosphorus. This he did clandestinely and Kunckel was hoist with his own petard.

However, it is told that Kunckel later on managed to inveigle Brandt, through an intermediary named Homberg, to furnish him also with the precious formula. In payment whereof he furnished Brandt with a curious little device, then quite novel, consisting of a vari-colored little house tenanted in turn by a wooden man and a wooden lady—the former, as usual, staying indoors when the weather was stormy, and emerging when the sun was in smiles, one of those toy weather forecasters that are quite as reliable as the more modern and elaborate Government establishments that have the same purpose of existence.

And thus it was that Kunckel after all became possessor of the secret and soon established himself as the first practical manufacturer of phosphorus.

This is the story of the discovery of phosphorus, replete with oddities and incongruities—but it is interesting despite the fact that it rather disillusionizes the believer in the chivalry and honor of other days. Surely the world is getting better if written codes of ethics be any criterion.

I. G.

(With acknowledgment to *Wooton's Chronicles of Pharmacy.*)

SELECTED EDITORIAL

NEW LIGHT ON THE ORIGIN OF LIFE.

By Dr. Edwin E. Slosson.
(Science Service)

Was the first living being a plant or animal? How could either originate out of non-existing matter?

These are questions that have hitherto baffled scientists. They could trace back, more or less satisfactorily, the lines of development of plants and animals to the simplest and most primitive forms of life, but there they ran up against an insurmountable wall on the near side of which was the world of living organisms and on the far side the world of inert mineral and inorganic matter.

We all know that non-living matter can be converted over into living matter for we do that ourselves whenever we eat or breathe. We all know that green plants have the power of building up sugar and starch and wood (the so-called carbohydrates) out of the water of the soil and carbon dioxide of the air, for we can see them do it any sunny day. But it is life only that can bring into the living organism this inorganic material. Water and carbon dioxide, which is plain "soda water," does not spontaneously change over into sugar or start to grow into a plant. It requires green colored granules of the leaves, called chlorophyll, to effect this transformation.

But chlorophyll is a very complicated chemical compound. It is formed only by green plants as they develop in the sun's rays from white sprouts. So the plant must exist before chlorophyll is formed. But on the other hand a plant could not exist unless it got its energy from the sugar and other stuff stored up previously by some chlorophyll-bearing plant. Even the simplest green plant cannot live and grow on its nutritive salts in the sunshine unless it has a bit of plant-stuff to feed on as a starter.

We might surmise as a way out of the dilemma that animal life came first on the earth and in decaying supplied the primitive plants with the necessary organic food stuff. But here we are blocked be-

cause animals are parasites of plants. They live on the sugars and so forth that the green leaves have stored up by means of sunshine.

So this was the perplexing situation. Plants can feed on animals or other plants. Animals can feed on plants or other animals. But where could the first animals or plants get food when there was nothing but mineral matter in the world? It was worse than the old question, which came first, the hen or the egg?

But of late we are beginning to get light on the problem. The wall between the living and non-living is crumbling down. Certain sugars and proteins, such as the plant forms that we eat, can now be made in the laboratory out of inorganic material. Artificial cells have been constructed that grow and crawl and feed themselves and stick out feelers and sub-divide very much like living cells. It has been found that ultra-violet rays, that is, light of such short waves that it cannot be seen, can convert water and carbon dioxide into sugar as chlorophyll does.

These short waves are not contained in the sunshine that reaches the earth today, but it is found that ordinary rays may act the same way in the presence of certain substances such as iron rust in water. These same energetic rays are able to incorporate the nitrogen of mineral salts into compounds like the protein of the living cell. So here we see the possibility that the action of the sunlight on the sea in primordial periods—or even in the present—might produce sufficient food to give a single cell a start in life and enable it to grow and multiply and develop into other and higher forms.

But how this primal cell got to going in this way the biologists are only beginning to surmise. Dr. E. J. Allen, at the recent Hull meeting of the British Association for the Advancement of Science, ventures the theory that the first organism was of the animal sort and spherical shape, but that it gradually grew a tail or whip that enabled it to rise to the sunny surface of the sea whenever it sank below and that it there acquired the chlorophyll by which it could make its own food out of the air and water. This is far from knowing what did happen in those early days, but it is a great advance to be able even to speculate as to how it might have happened since not many years ago it seemed that it could not happen at all.

ORIGINAL PAPERS

THE TOXIC CONSTITUENT OF GREASEWOOD (SARCOBATUS VERMICULATUS).*

By James F. Couch.

Introduction. Sarcobatus vermiculatus, known in the mountain States as "greasewood," is a perennial, classified in the Chenopodiaceæ. It occurs abundantly on "alkali" soils in the semi-arid valleys, is somewhat bushy, and generally grows to a height of four to five feet. The stems and larger branches are tough and woody; the green succulent portions of the plant are the leaves, blossoms, fruits and the very small, recently grown branches. All of these latter are salty and alkaline to the taste without perceptible acidity. This lack of acidity is of considerable interest in connection with the problem of the manner in which the plant acids are combined.

Although greasewood is an important fodder plant and is extensively grazed by sheep upon the winter range, it has caused several well-authenticated cases of poisoning in these animals. In order to establish the facts connected with the poisonous properties of the plant a detailed study of the subject was begun by the Office of Investigations of Stock Poisoning by Plants, of this Bureau. The preliminary results of this investigation are in course of publication by the Bureau of Animal Industry.

The writer was assigned the task of determining the nature of the poisonous principle, and an account of the chemical study of the plant forms the subject matter of this communication.

The problem was first proposed and the investigation was begun while the writer was engaged in field work at the experiment station near Salina, Utah, maintained by the Bureau of Animal Industry for the study of stock-poisoning plants. A number of extracts of the fresh plant were made; these were administered to sheep either without further treatment or after fractionation to include or eliminate certain classes of substances. Of 12 sheep used in these experiments, two were made sick and two others were killed by the extracts administered. As a result of this work it was definitely known that the poisonous constituent is soluble in water, insoluble in alcohol; and the common organic solvents, is not alkaloidal,

*Contribution from the Pathological Division, Bureau of Animal Industry, United States Department of Agriculture, Washington, D. C.

glucosidal, nor saponinic, but is a mixture of neutral potassium oxalate and neutral sodium oxalate. The proportion of oxalic acid (deprived of the potassium) in the plant is not great enough to cause symptoms of poisoning in sheep in doses thrice that of the lethal dose of plant when force-fed (as determined by Marsh, Clawson and Couch), and the proportion of potassium itself (deprived of oxalic acid) is likewise not great enough to cause poisoning in the same large doses. This consideration led to the conclusion that the poisoning is due to the salt, potassium oxalate, mixed with sodium oxalate, and this mixture is, therefore, stated to be the toxic constituent.

Earlier Investigations of Sarcobatus. The greasewood early attracted attention because of its alkali-resisting properties and its fodder value. It was, therefore, subjected to analysis in several institutions. One of the earliest of the published reports was by Goss and Griffin,[1] who made an extensive study of the soil conditions in the Rio Grande and Animas valleys of New Mexico. Their analysis of the ash of the air-dried plant showed:

	Per cent.
Ash	13.12
Silica	3.00
Potash	22.06
Soda	23.89
Lime	6.52
Magnesia	1.35
Manganese	Trace
Fe and Al, by difference	4.73
P_2O_5	4.12
SO_3	4.33
Carbon dioxide	23.80
Chlorine	8.01
Total	101.81
Oxygen equivalent of chlorine	1.81
Corr. total	100.00

These results show the large proportion of potassium and sodium in the plant, and the amount of carbon dioxide points to a large proportion of organic acid.

The ash of *Sarcobatus vermiculatus* was investigated by the

[1] *New Mexico Sta. Bul. No. 22*, March, 1897. "Alkali in the Rio Grande and Animas Valleys." By Arthur Goss and H. H. Griffin.

Division (now Bureau) of Soils of the Department of Agriculture. The plant specimens which were used were collected near Salt Lake, Utah, about 150 miles north of the region where the plants studied by the writer were collected. The results of the study in the Division of soils were reported in two papers, the first by Cameron and Gardner,[2] who state: "A striking feature was the much greater percentage of ash obtained from the leaves and blossoms than from the stems, and the markedly larger percentage of alkali salts in the ash of the former. Another interesting point is that the leachings of the air-dried leaves and blossoms were shown to contain about three times as much sodium as would be necessary to balance the hydrochloric and sulfuric acids in the plant. It is, therefore, probably present very largely in organic combination and upon the decay of the plant tissues would be expected to yield large amounts of sodium carbonate."

A second publication from the Division of Soils [3] contains the following data:

	Leaves and Blossoms. I.	Leaves and Blossoms. II.	Stems.
Ash % of Plant	25.85	23.47	4.94
Sodium Carbonate, % of Ash	51.93	57.90	29.46
Sodium Chloride, % of Ash	20.47	22.24	14.31
Sodium Sulfate, % of Ash	7.97	——	3.69

Two 5-gm. samples of the leaves and blossoms extracted with water gave a slightly acid extract which contained 5.81 per cent. and 5.68 per cent. of sodium chloride. Two samples of leaves and blossoms, subjected to the Carius process, yielded silver chloride equivalent to 5.43 per cent. and 5.43 per cent. of sodium chloride.

Forbes and Skinner [4] reported a proximate analysis of *Sarcobatus* as follows:

	Per cent.
Water	4.55
Ash	14.41
Protein	19.86
Fiber	24.50
N free extract	34.28
Ether extract	2.45

[2] *Proc. Soc. Prom. Agric. Sci.*, 1900; pp. 162-3. "Formation of Sodium Carbonate or Black Alkali by Plants."

[3] "Formation of Sodium Carbonate or Black Alkali by Plants." By Frank K. Cameron, in *Report No. 71, U. S. Dept. Agric.*, 1922; pp. 61-70.

[4] *Fourteenth Annual Report, Arizona Exp. Sta.*, 1903; p. 349.

In Bulletin No. 94 of the California Station, E. W. Hilgard [5] reports an analysis of the ash of "*Sarcobatus vermiculatus*" made by M. E. Jaffa. The plant used was collected in Kern County, California, and was later found to be *Allenrolfea occidentalis* [6] and not *Sarcobatus*.

None of the earlier investigators determined the nature of the organic acid with which so much of the basic elements of the plant is combined.

The Present Investigation.

The Material. The material used in the present investigation was all collected at the same place, *viz.*, the sandy valley at the mouth of Salina Canyon, about one and one-half miles east of the city of Salina, Utah. The elevation at this place is about 5,100 feet above sea level. The collections were made at intervals during the months of July, August and September, 1921, and included plants in flower and in fruit. The greater part of the material was used immediately after collection; the remainder was air-dried under cover. The whole was carefully hand-picked and the larger woody and inedible stems were discarded. The material used for chemical examination was identical in all respects with that fed to the experimental sheep by Marsh, Clawson and Couch. The portions of the extracts which remained after the animal experiments were concluded, together with a quantity of the air-dried plant, were shipped to Washington, D. C., in September, 1921, and the investigation was continued at that place.

Methods. The determination of the ash, oxalic acid content, and water-soluble material in *Sarcobatus* present certain difficulties, and it was necessary to devise some modifications of ordinary analytical procedure in order to obtain true results. In the ashing of the plant the large amounts both of carbonates and of chlorides cause much trouble, the first by fusing and enveloping particles of carbon, which cannot then be oxidized, and the second by their volatility, which prevents the use of high temperature. It was finally found possible to ash the plant properly and to obtain concordant results by

[5] "The Fertilizing Value of Greasewood." *Calif. Sta. Bul. No. 94*, 1891.

[6] *Cf. Calif. Sta. Bul. No. 125* (1899), p. 28, and *Bul. No. 128* (1899), p. 38. This plant is known as "greasewood" in Southern California.

proceeding as follows: The weighed sample, preferably in a platinum dish or crucible, is dried to constant weight in an electric oven at 110°; then the covered crucible containing the dry sample is heated on an asbestos board over a Bunsen flame at a low temperature until the greater part of the volatile organic products has been driven off, the greatest care being taken that the temperature is kept so low that the alkaline carbonates do not fuse. By proceeding in this way there is obtained a friable mass which contains the ash mixed with some carbon. To elminate the latter the open crucible is heated over a free, hot flame in such a way that the temperature reaches dull redness in about half a minute and, as soon as the carbonates begin and weighed. The ash thus obtained is slightly gray in color, but in to fuse, the heat is removed and the crucible is cooled in a desiccator no case was the carbon content weighable.

The oxalic acid was determined by precipitation with calcium chloride under the usual analytical conditions and weighing the calcium oxide remaining from the ignited precipitate. The large amount of colloidal matter in the plant extract caused considerable trouble by preventing the proper deposition of the precipitate and making it impossible to accomplish a complete separation by filtration. These difficulties were overcome by proceeding in the following manner: Weighed portions of the plant were extracted with boiling water in successive portions until no further test for the acid could be obtained in the last portion. The filtered and mixed aqueous solutions were made slightly alkaline with ammonium hydroxide and were then evaporated just to dryness. The extract was kept in a warm place for at least 24 hours and was then redissolved in warm, distilled water, filtered, if necessary, from flocculated protein, made alkaline with ammonium hydroxide, acidified with acetic acid, heated to boiling, and precipitated by a hot solution of calcium chloride with vigorous stirring, kept hot for six to seven hours, allowed to cool over night, filtered through an ashless filter paper, thoroughly washed and the precipitate ignited over a Meker burner until the weight of the residue was constant. From this the amount of water-soluble oxalic acid was calculated.

The marc from the water extraction was then extracted with hot hydrochloric acid in order to determine the quantity of calcium oxalate in the plant. The filtered extract was made alkaline with ammonium hydroxide, which precipitated the calcium oxalate, and,

to avoid difficulties in filtration, the whole was evaporated just to dryness, allowed to stand, redissolved in hot 1 per cent. hydrochloric acid, treated with ammonium hydroxide, and then with excess of acetic acid, and the calcium oxalate was filtered off, washed, ignited, and weighed as calcium oxide.

By this procedure concordant results could be obtained, especially with the determination of the calcium oxalate. The results obtained are recorded in Table 1. Two different samples of the plant were used. No. 21-160 was collected August 25, 1921, and No. 21-168 was collected September 13, 1921. The latter sample had all been ground to a coarse powder so that it was impossible to separate the fragments of the stems from the leaves. No. 21-160 was therefore used as a source of the leaves and stems analyzed.

TABLE 1—OXALIC ACID CONTENT OF DRIED PLANT.

	Leaves, Stems, Fruit. No. 21-168. Per Cent.	Stems. No. 21-160. Per Cent.	Leaves. No. 21-160. Per Cent.
Moisture	8.64	5.82	5.50
Ash, as of Dry Plant	12.25	10.11	24.79
Water Soluble Oxalic Acid, Anhydrous	9.40	2.35	10.47
Calcium Oxalate, $CaC_2O_4.H_2O$	3.47	4.95	2.80
Total Anhydrous Oxalic Acid	11.54	4.37	12.20

Experimental.

1. *The Isolation and Identification of Oxalic Acid.* Five kilos of the fresh plant, leaves, stems and fruits were passed through a meat chopper and the minced product was packed into a tinned iron percolator and completely extracted with hot water. The watery extract when heated developed the characteristic odor of canned tomatoes. It was concentrated by evaporation to a small bulk, a sample was taken for tests, and the remainder was reduced to the consistency of a soft extract. The sample taken for tests gave the following reactions: silver chloride threw down a heavy, curdy precipitate insoluble in nitric acid and soluble in ammonium hydroxide; barium chloride produced a heavy white precipitate, almost completely soluble in dilute hydrochloric acid but insoluble in acetic acid; ammonium oxalate produced no precipitate; hydrochloric acid caused no change in the cold, but on warming, an acrid gas, resembling furfurol, was

evolved; the extract was slightly acid to litmus; it did not reduce alkaline copper solutions, but after heating with mineral acids and alkalizing it caused a copious precipitation of cuprous oxide. On heating the solution with sodium hydroxide an alkaline gas with a faint odor of trimethylamine was evolved; when acidified with hydrochloric acid the solution gave a faint precipitate with Mayer's reagent, but no alkaloid could be removed by shaking the alkaline solution with immiscible solvents; on mixing the solution with a saturated solution of tartaric acid and allowing to stand, a heavy precipitate of potassium acid tartrate crystallized out.

A solution of a part of the extract was made so that 1 ml. was the equivalent of 1 gm. of green plant. The ash, extract, and oxalic acid content of this solution was determined, *viz.*,

10 ml. yielded:

Anhydrous oxalic acid, 0.2258 gm. or 2.26% of green plant.

Extract, total solids, 1.0933 gm. or 10.933 gm. per 100 ml.

Ash, 0.4720 gm. or 4.72% of green plant.

The main portion of the solution, equal to 900 gm. of green plant, was concentrated to about one-half its volume, slightly acidified with hydrochloric acid and kept in a cold place. After two weeks some twenty grams of crystals mixed with much amorphous matter had been deposited. The solution was decanted from the solid matter and this was subjected to repeated recrystallization until a pure, white, crystalline product was obtained. A solution of this substance in water was positive to the usual tests for oxalates and to Chernoff's[7] very beautiful color reaction for oxalic acid. Analysis of the bases showed 41.24 per cent. of the total bases potassium, and the remainder (or 58.76 per cent.) sodium. Another portion of the substance was mixed with alcohol and an excess of con. hydrochloric acid was added. The mixture was warmed and stirred and after an hour was filtered. On removing the alcohol a white crystalline substance remained which responded to tests for oxalic acid. The substance was, therefore, a mixture of sodium and potassium acid oxalates.

[7] *J. Am. Chem. Soc.*, 42, 1784 (1920).

2. *The Evidence of the Toxicity of the Oxalates in the Plant.* An aqueous extract of 10 kilos of the green plant similar to that described under one was concentrated to a small volume and was then repeatedly extracted with large volumes of hot alcohol. By this means the extract was divided into two fractions, an alcoholic solution and an insoluble residue. The substances dissolved by the alcohol were recovered by removing the solvent and a portion equivalent to 2,000 gm. of the green plant (about thrice the M. L. D.) was dissolved in a little water and was administered per os to sheep No. 622 without affecting the animal. The alcohol insoluble residue weighed 480 gm. and consisted of the mixed oxalates of sodium and potassium with small amounts of proteins, gums, and carbohydrates. Analysis subsequently showed it to contain 39.78 per cent. of anhydrous oxalic acid. Ninety-six grams of it, equivalent to 2,000 gm. of green plant, were dissolved in a little water, filtered from some insoluble matter, and were administered per os to sheep No. 638. The animal became sick, the symptoms being rapid and shallow respiration, weak and rapid pulse, and increased temperature. It finally died in cardiac collapse 2 hours and 57 minutes after the dose was administered. The symptoms shown were not different from those observed in animals poisoned by feeding on the plant.

The Oxalic Acid Alone.

Another portion of this alcohol-insoluble mass, of the same weight, *viz.*, 96 gm., equivalent to 2,000 gm. of green plant, was dissolved in water, filtered, and the greater part of the potassium was removed from the solution by precipitation as the acid tartrate, leaving all the oxalic acid in solution. The solution was then administered per os to sheep No. 631, without affecting the animal. This shows that the oxalic acid, *per se*, is not in sufficient concentration to account for the range poisoning.

The Potassium Alone.

In order to determine what rôle the potassium may play the following experiment was performed: Fifteen hundred grams of the green plant was charred over a moderate flame until all the organic matter was destroyed and only the ash with a large amount of carbon remained. The soluble materials were leached out of this mass and

were neutralized with acetic acid. The equivalent of 100 gm. of green plant was reserved and the remainder, equivalent to 1400 gm. of green plant, or twice the lethal dose, was administered per os to sheep No. 650. It did not affect the animal. Evidently there is not enough potassium in the plant, *per se*, to account for the range poisoning, and the conclusion is forced that the observed poisoning is due to the mixed salts. From toxicological considerations it is probable that the sodium is relatively harmless and that the potassium and the oxalic acid are the real toxic agents in the plant.

Examination of the Urine of Sheep Fed on Sarcobatus.

A number of sheep were penned up singly and were given as much freshly collected greasewood as they would eat, this work forming a portion of Mr. Clawson's experiments. Two of these animals, Nos. 613 and 614, after they had been feeding for some time upon the plant, were put into a metabolism cage and the urine voided during 24 hours was collected. At the time of collection sheep No. 613 had eaten 142.5 pounds in 32 days and sheep No. 614 had eaten 134.75 pounds in 33 days. The results of the clinical examination of the fresh urine follow. An analysis of a 24-hour sample from sheep 613 taken more than two months later, when the animal was wholly normal, is added for the sake of a comparison.

TABLE 2—ANALYSIS OF URINE OF SHEEP.

	Sheep in Normal Condition. No. 613. Sept. 18, 1921.	Sheep Feeding on Sarcobatus. No. 613. July 12, 1921.	No. 614. July 13, 1921.
Volume	780 ml.	5754 ml.	3495 ml.
Specific Gravity	1.030	1.019	1.023
Reaction	Alkaline.	Alkaline.	Alkaline.
Reducing Substances	0	0	0
Albumens	0	0	0
Urea	35.98 gm.	67.21 gm.	43.61 gm.
Total Solids	54.52 gm.	175.79 gm.	....
Biliary Acids	0	Present.	Present.

Tests for oxalates showed that there was only a very small quantity of combined oxalic acid excreted in the urine.

The Search for Other Toxic Compounds in the Plant. In order to make sure that the oxalates were the only poisonous substances

present in *Sarcobatus* a series of experiments were conducted with fractionated extracts from the plant, and a brief description of this part of the investigation follows.

Volatile Substances. Eighteen hundred grams of the fresh plant was made alkaline by soaking in a solution of 36 gm. of KOH in 5 liters of water and then the mass was distilled. The first portions of the distillate were alkaline, but shortly neutral distillate came over. The distillation was continued until pure water was collected. A quantity of the distillate equivalent to 700 gm. of the plant was administered per os to sheep No. 625, and did not affect the animal.

Saponins. The green plant has a "soapy feel" and its aqueous extracts form persistent froths. Accordingly two different methods for the extraction of saponins were applied to samples of the plant, and the solutions so obtained, which should have contained all of the saponins, if any, present in the plant, were administered to sheep. In no case was any animal affected. In addition, at none of the autopsies of animals which died after being poisoned with this plant was there any evdence of hemolysis.

Portions of the water extract were dissolved in 0.85 per cent. sodium chloride solution and were made up to the following concentrations, calculated to green plant: 4 per cent., 8 per cent., 20 per cent. and 40 per cent. These were tested against a 3 per cent. suspension of washed sheep's corpuscles in normal salt solution, but in no case showed any evidence of hemolysis.

It may therefore be said that toxic saponins are absent from the Sarcobatus.

Hydrocyanic acid and cyanides. Routine tests for cyanogen compounds were applied to several of the extracts. None of the tests were positive.

Alkaloids. A portion of the water extracts of the green plant, which, after acidifying with hydrochloric acid, yielded a precipitate with Mayer's solution, was made alkaline with a slight excess of sodium hydroxide and was shaken out with chloroform. On separating the chloroform layer, washing it with faintly alkaline water, and then shaking it with dilute acid, no alkaloid was obtained. The extract was then extracted again by shaking with ether, the ether

layer was separated and treated in the same way as the chloroform solution, and no alkaloid was obtained. It was therefore concluded that the precipitate with Mayer's solution was due to some non-alkaloidal constituent of the plant.

Glucosides. The fact that the water extract of the green plant reduces alkaline copper solutions only after hydrolysis pointed to the probable presence of a glucoside or some disaccharose or poly-saccharose. An attempt was therefore made to isolate a glucoside, but without success. The reducing substance is soluble in alcohol and several fractions which contained it were administered per os to sheep. None of these experimental animals were affected by the extracts, and consequently no toxic glucoside is present.

Summary.

The common greasewood of the mountain States (*Sarcobatus vermiculatus*) has been investigated for toxic constituents. Large quantities of potassium and sodium oxalates were found, and these are responsible for the cases of range poisoning. Toxic alkaloids, glucosides, and saponins are absent. Hydrocyanic acid or its compounds was not found in the plant.

The writer wishes to express his thanks to Dr. C. D. Marsh, Mr. A. B. Clawson and Mr. G. C. Roe for their kindly advice, criticism, and assistance during this investigation.

Washington, D. C.

THE VOLUMETRIC DETERMINATION OF PHOSPHORIC ACID AND OF SODIUM PHOSPHATE AND PYROPHOSPHATES.*

By Frank X. Moerk.

The paper on "Methyl-orange as an Indicator in Presence of Indigo-carmine," read at the meeting of this Association in 1921, was followed by another paper read before the Scientific Section of the American Pharmaceutical Association on "Modified Methyl-orange Indicator in Titrating Phosphoric Acid and Phosphates."

*Presented to the 1922 Meeting of the Pennsylvania Pharmaceutical Association.

The important points in these papers are as follows:

(1) The indicator used for quantitative experiments contained 0.1 gm. methyl-orange and 0.3 gm. indigo-carmine in 100 cc. water; as it was found that this mixed indicator deteriorated on keeping, the two reagents were kept in separate solutions and 0.2 cc. of each added to 100 cc. of water, or other liquid, in which the titration was to be made.

(2) Alkaline hydroxides cause the decomposition of the indigo-carmine and the reaction then is due to the methyl-orange only; if NaOH or KOH is to be titrated it will be necessary to add the NaOH or KOH to an excess of an acid and determine the excess of the acid with an alkali.

In titrating phosphoric acid in presence of excess of calcium chloride or of lead nitrate the indigo-carmine is precipitated and the end-reacton is due the methyl-orange only.

In titrating phosphoric acid in presence of silver nitrate the indigo-carmine is quickly oxidized and the methyl-orange more slowly changed in some way so that a colorless supernatant liquid finally results.

(3) The addition of sodium chloride to solutions to be titrated has the effect of decreasing the amount of acid V. S. in titrating sodium phosphate and of increasing the amount of alkali V. S. in titrating phoshoric acid. The results of adding varying quantities of sodium chloride gave warrant for the concluding statement, "it seems likely that, with the aid of the modified indicator and in presence of sodium chloride, a method will be found for directly titrating phosphoric acid and sodium phosphate; the necessary quantity of sodium chloride will be found to differ for these two substances."

(4) In the U. S. P. IX process for the assay of phosphoric acid and sodium phosphate (the former in a preliminary step is practically converted into sodium phosphate), silver nitrate is added in excess to enable the formation of normal silver phosphate, which, however, is not completely precipitated until a neutralizing agent is added to take care of the acid liberated in the formation of silver phosphate:

$$Na_2HPO_4 + 3AgNO_3 = Ag_3PO_4 + 2NaNo_3 + HNO_3.$$

For this purpose zinc oxide free from chloride is to be added until a neutral reaction to litmus results; as soluble zinc salts of the mineral acids have an acid reaction to litmus an unnecessarily large excess of zinc oxide may be added. The mixture of liquid, silver phosphate and excess of zinc oxide is next made up to a definite volume, filtered and, in an aliquot portion of the filtrate, the excess of silver nitrate determined and calculation made to phosphoric acid or sodium phosphate; as no allowance is made for the volume of the insoluble material the results calculated from the titration must be low; all salts and acids forming silver salts insoluble in neutral solution will be included in this assay and the results will be correspondingly high.

If a solution of phosphoric acid or of sodium phosphate be mixed with an excess of silver nitrate and then sodium hydroxide V. S. be added from a burette a transient brown color or precipitate of silver oxide will be produced, which disappears quickly upon stirring because changed into yellow silver phosphate; a permanent brown tint shows the end of the formation of silver phosphate and is best seen in a portion of the decanted supernatant liquid. This modification of the silver nitrate process depends upon neutralization and can only be affected by presence of other substances capable of neutralizing alkalies. The working details of this titration will be given a little further on.

Three molecules of silver nitrate will react with one molecule of either phosphoric acid or sodium phosphate, requiring for neutralization, however, with the former three molecules of sodium hydroxide, with the latter one molecule of sodium hydroxide.

Phosphoric Acid.

NaOH V. S. contains in 1 cc. 0.2463 gm. NaOH the equivalent of

0.0603653 gm. H_3PO_4 using indicator;
0.0201218 gm. H_3PO_4 in presence of $AgNO_3$.

Method of Neutralization Using Indicator.

To 100 cc. distilled water or other specified liquid, add 0.2 cc. each of the methyl-orange solution (0.1 gm. per 100 cc.) and indigo-carmine solution (0.3 gm. per 100 cc.), then add a dilute HCl solu-

tion (about decinormal), drop by drop, until the green color changes without producing a violet color and divide the solution into two equal portions placing these portions in beakers of the same internal diameter. (This procedure will ensure the same tint in both portions, whereas the directions previously given, namely, to add 0.1 cc. of each of the colored liquids to two portions of 50 cc. water, or other specified liquid, and treating these separately with HCl, often gave differently tinted solutions.) To one of these portions add the solution to be tested and titrate with NaOH V. S. until the color matches the reserved portion; for final decision in the matching hold the beakers over a white surface and look down through the liquids. If desired a check titration can next be made by adding another portion of the solution to be tested to the reserved portion and matching this against the previously titrated solution.

Interpret the per cent. NaCl specified in some titrations as grams per 100 cc.

Method of Neutralization in Presence of Silver Nitrate.

Place a calculated excess of 10 per cent. silver nitrate solution which must be neutral (ensured by adding NaOH V. S. to the stock solution of silver nitrate until a brown precipitate forms, allowing the precipitate to settle and decanting the clear solution) in a beaker, add the solution to be tested and then NaOH V. S. with constant stirring; as the yellow silver phosphate becomes bulkier it will promptly settle so that part of the supernatant liquid can be decanted into another beaker and the titration continued; as the precipitate in this beaker increases, the mixture is transferred back to the original beaker, thoroughly stirred, the liquid decanted and titration continued until finally one drop NaOH V. S. produces a brown coloration not changing to yellow upon mixing with more of the supernatant liquid from the original beaker. (The silver nitrate necessary can be calculated from the weight taken for assay or from the results of the neutralization method with indicator; one molecule of phosphoric acid or sodium phosphate or of NaOH or HCl requires three molecules of silver nitrate.)

Results.

Ten cc. H_3PO_4 solution used for each titration:

H_3PO_4 in 10 cc.	A. 1.23431 Gm.		B. 1.08733 Gm.		C. 1.06945 Gm.	
	cc. NaOH	% H_3PO_4	cc. NaOH	% H_3PO_4	cc. NaOH	% H_3PO_4
Water	17.35	84.85	15.25	84.66	15.05	84.95
2.5% NaCl	17.5	85.58	15.35	85.22	....	....
5.0% NaCl	17.6	86.07	15.4	85.49	....	....
7.5% NaCl	17.7	86.56	15.6	86.61	15.35	86.64
10.0% NaCl	17.8	87.05	15.7	87.16	....	....
120 cc. 10% Ag NO_3 ..	53.1	86.56	....	....	....	....
100 cc. 10% Ag NO_3 ..	....	....	46.8	86.61	46.1	86.74

Notice that under the conditions of these experiments using about half-normal NaOH and about one gram H_3PO_4 excellent results were obtained with a 7.5 per cent. NaCl solution.

Sodium Phosphate.

HCl V. S. contains in 1 cc. 0.016277 gm. HCl the equivalent of 0.0633986 gm. Na_2HPO_4 using indicator.

NaOH V. S. contains in 1 cc. 0.02463 gm. NaOH the equivalent of

0.0874454 gm. Na_2HPO_4 using indicator or in presence of silver nitrate.

Method of Neutralization Using Indicator.

Directions as under Phosphoric Acid but titrate with HCl V. S. instead of NaOH V. S.

Method of Neutralization in Presence of Silver Nitrate.

Directions as under Phosphoric Acid.

Results.

Ten cc. of solution used containing 1.0238 gm. anhydrous Na_2HPO_4:

Water	16.10 cc. HCl	99.70% Na_2HPO_4
2.5% NaCl	16.00 cc. HCl	99.08% Na_2HPO_4
5.0% NaCl	15.90 cc. HCl	98.46% Na_2HPO_4
7.5% NaCl	15.85 cc. HCl	98.15% Na_2HPO_4
10.0% NaCl	15.80 cc. HCl	97.84% Na_2HPO_4
70 cc. 10% $AgNO_3$	11.70 cc. NaOH	99.93% Na_2HPO_4

At least two, in many cases three and four, titrations were made without variation in results. From experimental work contained in the previous paper titration of sodium phosphate with an acid V. S. in the absence of NaCl gave in most cases results a little higher than with alkali V. S. in presence of silver nitrate while the titration of phosphoric acid with alkali V. S. in absence of NaCl gave decidedly lower results than with alkali V. S. in presence of silver nitrate. In the above series of titrations the one in which silver nitrate was used gave the highest result; the only change in the working details has been mentioned and consisted in dividing the diluted and neutralized indicator into two equal portions. Another possible explanation suggested itself; in one case the solution was titrated with an acid V. S. while in the process of silver nitrate the solution was titrated with an alkali V. S.; theoretically this indicator should give identical results in the two methods of titrating, but to test the matter there was formulated a

Residual Method for Sodium Phosphate With Indicator.

Proceed with the directions under Method of Neutralization Using Indicator until the solution is divided into two equal portions; then to one portion add a measured quantity of acid V. S. (more than enough to overcome the alkalinity of the sodium phosphate, 20 cc. HCl V. S.), and titrate with NaOH V. S. to match the color of the reserved portion. Then add to the reserved portion the 10 cc. sodium phosphate solution to be used for the test, followed by the same quantity of acid V. S. (20 cc. HCl V. S.) as used in the previously titrated solutions and titrate the excess of acid V. S. with NaOH V. S.; the difference between the two titrations gives the cc. of NaOH V. S. equal to the sodium phosphate.

Results.

Sodium phosphate and volumetric solutions as stated above:

	20 cc. HCl V.S.	For excess HCl V.S.	For Na_2HPO_4	% Na_2HPO_4
Water	14.5 cc.	2.75 cc.	11.75 cc.	100.36
2.5% NaCl	14.5 cc.	2.80 cc.	11.70 cc.	99.93
5.0% NaCl	14.45 cc.	2.85 cc.	11.60 cc.	99.08
7.5% NaCl	14.45 cc.	2.90 cc.	11.55 cc.	98.65
10.0% NaCl	14.45 cc.	2.95 cc.	11.50 cc.	98.22
70 cc. 10% $AgNO_3$		......	11.70 cc.	99.93

Notice that under the conditions of these experiments using half-normal NaOH and about one gram Na_2HPO_4 concordant results were obtained with a 2.5 per cent. NaCl solution.

To ascertain the effect of using a more dilute alkali V. S. in titrating phosphoric acid and sodium phosphate an approximately fifth-normal NaOH V. S. was prepared and standardized with the HCl V. S. (1 cc. 0.016277 gm. HCl). Twenty cc. HCl V. S. were added to the diluted and neutralized indicator and titrated with NaOH V. S.

Water	+	20 cc. HCl V.S. required	42.8 cc. NaOH V.S.
1.0% NaCl	+	20 cc. HCl V.S. required	42.75 cc. NaOH V.S.
2.5% NaCl	+	20 cc. HCl V.S. required	42.75 cc. NaOH V.S.
10.0% NaCl	+	20 cc. HCl V.S. required	42.75 cc. NaOH V.S.

1 cc. NaOH V. S. in absence of added NaCl, or in presence of $AgNO_3$ represents

0.0083443 gm. NaOH equivalent to
0.0068169 gm. H_3PO_4 in presence of $AgNO_3$;

in presence of 1 per cent. to 10 per cent. NaCl represents
0.00835403 gm. NaOH equivalent to
0.02047489 gm. H_3PO_4.

Phosphoric Acid.

10 cc. containing 1.06945 gm. H_3PO_4 (86.74 per cent.) in presence of

7.5 per cent. NaCl required 44.9 cc. NaOH V. S. equal to 85.96 per cent.

10 per cent. NaCl required 45.2 cc. NaOH V. S. equal to 86.53 per cent.

In these titrations the final volume of liquid is practically 105 cc. against 75 cc. when the stronger V. S. was used, therefore the NaCl is considerably reduced which as stated before has a marked influence upon the results; by using a 10 per cent. NaCl instead of 7.5 per cent. the percentage of H_3PO_4 is raised to nearly the true content (86.74 per cent.).

Sodium Phosphate.

1 cc. HCl V. S. contains 0.016277 gm. HCl the equivalent of
0.0633986 gm. Na_2HPO_4 in absence of added NaCl;
1 cc. NaOH V. S. contains 0.0083443 gm. NaOH the equivalent of
0.0296252 gm. Na_2HPO_4 in absence of added NaCl or in presence of $AgNO_3$;

1 cc. NaOH V. S. contains 0.00835403 gm. NaOH the equivalent of
0.02966 gm. Na_2HPO_4 in presence of added NaCl.

10 cc. solution containing 1.0363 gm. Na_2HPO_4 were added to the prepared diluted indicator solution and titrated with HCl V. S., then the quantity of HCl V. S. was increased to 20 cc. and this solution titrated with NaOH V. S.

	Direct		Residual cc. NaOH required for 20 cc. HCl V.S.	Excess HCl V.S.	Na_2HP_4
	HCl V.S.	Na_2HPO_4			
Water	16.3 cc.	99.72%	42.8	7.9	34.9 = 99.77%
1.0% NaCl .	16.25 cc.	99.41%	42.75	8.05	34.7 = 99.31%
2.5% NaCl .	16.2 cc.	99.11%	42.75	8.15	34.6 = 99.03%
5.0% NaCl .	16.1 cc.	98.49%	42.75	8.3	34.45 = 98.60%
35 cc. 10% $AgNO_3$					34.8 = 99.48%

These experiments indicate that with a more dilute V. S., the NaCl content has to be decreased to check up with the silver nitrate and NaOH V. S. method.

There is no doubt, from the experiments recorded, processes can be devised for the assay of Phosphoric Acid and of Sodium Phosphate, if the weight of a substance taken for analysis, the strength of the volumetric solution to be employed and the liquid for the dilution of the indicator are specified.

Experience with the silver nitrate and NaOH V. S. method impresses one very favorably and so far as I know, is not affected by variation in the several influences mentioned in the indicator method. This method will be found suitable for phosphoric acid, for mono-sodium and for di-sodium phosphate; tri-sodium phosphate will give a neutral filtrate after the addition of silver nitrate and therefore this method will not be applicable.

Sodium Pyrophosphate.

In one of the earlier experiments in which sodium phosphate was rendered anhydrous by heating over a small flame, the supposedly anhydrous phosphate, after weighing, was dissolved in the prepared indicator and titrated with HCl V. S.; calculation made to Na_2HPO_4 gave close to 105 per cent. Some of the same lot of phosphate dried at 110° to 115° C. and titrated in the same manner gave 100.42 per cent Na_2HPO_4. The high results were explained upon the assumption that the phosphate was at least in part converted into pyrophosphate and that the latter acted towards acid V. S. like the phosphate, in other words, that two of the sodium atoms in the formula $Na_4P_2O_7$ were capable of neutralizing acid V. S.; expressed differently $H_4P_2O_7$ towards the indicator reacts like a di-basic acid.

Many of the text books, including the U. S. P., state that crystallized sodium phosphate becomes anhydrous at 100° C. and at a red heat is converted into pyrophosphate. The lowest temperature at which phosphate becomes pyrophosphate, that I have seen published is 200° C., although the same book in another place gives 250° C.

0.7812 gm. of a sample of crystallized sodium pyrophosphate dissolved in a water dilution of the indicator required 10.1 cc. HCl V. S. for neutralization, which calculated to $Na_4P_2O_7 10H_2O$ gave 100.06 per cent.

Upon closer inspection, the sample showed some opaque particles; dried at 110° to 115° C., a loss of 39.63 per cent. was noted compared with the theoretical loss of 40.37 per cent. A solution was next made, containing in 10 cc. 0.31294 gm. of the anhydrous salt, and with this solution a series of tests were made simliar to those made with the last Na_2HPO_4 solution, and with the same volumetric solutions.

1 cc. HCl V. S. is the equivalent of 0.0593774 gm. $Na_4P_2O_7$.

1 cc. NaOH V. S. is the equivalent of 0.027746 gm. $Na_4P_2O_7$ in the absence of added NaCl.

1 cc. NaOH V. S. is the equivalent of 0.027778 gm. $Na_4P_2O_7$ in the presence of added NaCl.

	Direct		Residual	cc. NaOH V.S. required for	
	HCl V.S.	$Na_4P_2O_7$	HCl V.S.	20 cc. HCl V.S.	Excess $Na_4H_2P_7$
Water	5.2 cc.	98.66%	42.8	31.55	11.25=99.74%
2.5% NaCl	5.15 cc.	97.72%	42.75	31.6	11.15=98.97%
5% NaCl ..	5.15 cc.	97.72%	42.75	31.6	11.15=98.97%

7 cc. 10 per cent. $AgNO_3$ with 20 cc. H_2O gave a white precipitate turning pink (arsenate?), the decanted liquid gave no further precipitate with $AgNO_3$ and required 0.2 cc. NaOH V. S. to produce a brown color.

One of the most interesting points shown in these titrations is the comparatively slight influence of NaCl; should this also be true with stronger solutions it opens the possibility of determining Na_2HPO_4 after converting it into pyrophosphate.

Chemical Laboratories,
Philadelphia College of Pharmacy and Science,
June, 1922.

METHYL-RED IN THE ASSAY OF PHOSPHORIC ACID AND SODIUM PHOSPHATE.

By Frank X. Moerk and Edward J. Hughes.

While the silver nitrate and alkali V. S. method described in the preceding article gave very good results, the discovery of an indicator suitable for this method was considered worthy of further efforts.

Of a number of indicators tried only two, methyl-red and litmus, gave encouraging results.

Methyl-red Indicator made according to the U. S. P. IX responded as follows using three drops per test with approximately deci-normal volumetric solutions:

10 cc. H_2O a red color turning yellow upon addition of 0.025 cc. KOH V. S.

10 cc. H_2SO_4 V. S. required 10.95 cc. KOH V. S.

10 cc. H_2SO_4 V. S. + 40 cc. $AgNO_3$ V. S. required 10.95 cc. KOH V. S.

10 cc. of a H_3PO_4 solution and 40 cc. Ag NO_3 V. S. required 38.4 cc. KOH V. S.

50 cc. $AgNO_3$ V. S. a red color turning yellow upon addition of a trace of KOH V. S.; 10 cc. H_2SO_4 V. S. added to this neutralized solution required 10.95 cc. KOH V. S.; lastly, the addition of 10 cc. of the same H_3PO_4 solution required 38.4 cc. KOH V. S.

The titration of 10 cc. H_2SO_4 V. S. using the mixed indicator required 10.95 cc. of the KOH V. S. agreeing exactly with the results obtained above with methyl-red.

Methyl-red does not give a sharp end-reaction in titrating carbonates and cannot be used in titrating phosphoric acid or sodium phosphate in the absence of silver nitrate. In titrating the latter substances it was noticed that the red color became quite faint as the silver phosphate precipitated and in subsequent quantitative determinations only one drop of indicator was added at the beginning of the titration the other drops being added, one at a time, as the color faded.

Experiments having for their object the replacement of silver nitrate by another metallic salt, were unsuccessful; one of these experiments, however, was quite interesting: methyl-red added to a mixture of magnesium sulphate and ammonium chloride produced an orange color and required but little KOH to produce a yellow; 10 cc. of a sodium phosphate solution were next added and the yellow color did not change until $MgNH_4PO_4$ started to precipitate when a red tint was observed; the disappearance of the red and formation of a permanent yellow required a total of 11.3 cc. KOH V. S.; the same quantity of sodium phosphate in the presence of silver nitrate V. S. required 14.3 cc. KOH V. S. showing that the neutralization was not complete in the presence of magnesium sulphate and ammonium chloride.

Litmus Indicator. The use of litmus paper to record final neutrality in the U. S. P. IX assay of phosphoric acid and sodium phosphate suggested a trial with litmus solution; acids in presence of silver nitrate can be readily titrated with an alkali V. S. providing soluble silver salts only are produced, but should an insoluble silver salt be produced, as in the official process, the litmus color disappears before neutrality is reached.

> 50 cc. $AgNO_3$ V. S. (tinted blue with litmus solution were made faintly acid with H_2SO_4 V. S. and the blue tint just restored by the addition of KOH V. S.) were mixed with 10 cc. of sodium phosphate solution and titrated with KOH V. S.; the red color became fainter as the KOH was added and finally a colorless supernatant liquid was produced, which, tested with litmus paper, however, still showed an acid reaction; 14.25 cc. KOH V. S. were required before litmus paper showed a neutral

reaction. The solutions used in this experiment were the same as those used in later determinations; calculated to anhydrous Na_2HPO_4 this assay indicated 93.07% Na_2HPO_4.

The following data covers the standardization of the volumetric solutions used in a comparison of assay processes:

Sodium Chloride V. S. 6.177 grams of NaCl per liter.

10 cc. NaCl V. S. with 20 cc. $AgNO_3$ V. S. required, in presence of nitric acid and ferric-ammonium sulphate T. S., 9.3 cc. KCNS V. S.

10 cc. $AgNO_3$ V. S. required, in presence of nitric acid and ferric-ammonium sulphate T. S., 9.95 cc. KCNS V. S.

20 cc. $AgNO_3$ V. S. are equal to 19.9 cc. KCNS V. S.

50 cc. $AgNO_3$ V. S. are equal to 49.75 cc. KCNS V. S.

10 cc. NaCl V. S. are equal to 10.6 cc. KCNS V. S.

1 cc. KCNS V. S. is the equivalent of

0.0032582436 gm. of H_3PO_4, or

0.0047199012 gm. of Na_2HPO_4.

Sodium Carbonate V. S. 9.518 grams Na_2CO_3 per liter.

10 cc. Na_2CO_3 V. S. added to 50 cc. of neutralized water-dilution of mixed indicator (see under sodium phosphate) followed by 20 cc. H_2SO_4 V. S. required 4.05 cc. KOH V. S.

10 cc. H_2SO_4 V. S. added to 50 cc. of neutralized water-dilution of mixed indicator required 11.25 cc. KOH V. S.

20 cc. of H_2SO_4 V. S. are equal to 22.5 cc. KOH V. S.

10 cc. of Na_2CO_3 V. S. are equal to 18.45 cc. KOH V. S.

1 cc. of KOH V. S. is the equivalent of

0.0031815891326 gram of H_3PO_4 in presence of $AgNO_3$.

0.0095447673978 gram of H_3PO_4 with mixed indicator.

0.0138265777 gram of Na_2HPO_4 in presence of $AgNO_3$ or with mixed indicator.

Comparison of the Results of Assays.

Sodium Phosphate.—2.117 grams of so-called Dried Sodium Phosphate were dissolved in water to make 100 cc. of solution.

10 cc. were used for each of the following determinations:

U. S. P. IX Method:

(1) 50 cc. of filtrate required 4.35 cc. KCNS V. S.

49.75 — (4.35 × 2) = 41.05 cc. KCNS V. S. = 91.52% Na_2HPO_4.

(2) 50 cc. of filtrate required 4.3 cc. KCNS V. S.

49.75 — (4.3 ×2) = 41.15 cc. KCNS V. S. = 91.74% Na_2HPO_4.

Silver Nitrate and Alkali V. S. Method, Methyl-red Indicator.

To 50 cc. of $AgNO_3$ V. S. add one drop of methyl-red and a trace of KOH V. S. to produce a yellow color, next add 10 cc. of the solution to be assayed and titrate with KOH V. S. until the red or pink color changes to yellow; in the course of neutralization the pink color fades and if a drop of methyl-red restores the red color more KOH will be needed. Three drops of the indicator, using one drop at a time, were found sufficient in the titrations; the silver phosphate, towards the end settles promptly and the comparatively clear supernatant liquid can be decanted, titrated, returned to the original beaker and mixed with the residual liquid and precipitate; after the precipitate settles the operations just described can be repeated as often as necessary until a supernatant yellow liquid is obtained.

Duplicate assays gave 14.3 cc. of KOH V. S. = 93.39% Na_2HPO_4.

Residual Method with Mixed Indicator.

Preparation of the neutralized water-dilution of the mixed indicator. To 100 cc. of distilled water add 0.2 cc. each of the methyl-orange solution (0.1 gm. per 100 cc.) and indigo-carmine solution (0.3 gm. per 100 cc.), then add carefully a deci-normal acid V. S. until the green color changes without producing a violet color (should the latter color be obtained add sufficient alkali V. S. to restore the green color and then more cautiously add the acid V. S.); divide the solution into two equal portions, placing these portions in beakers of the same internal diameter. To one of these portions add 10 cc. of the sodium phosphate solution and 20 cc. H_2SO_4 V. S. and titrate with KOH V. S. until the color matches exactly the color of the reserved por-

tion; in this matching hold the beakers over a white surface and look down through the liquids.

In duplicate titrations 14.3 cc. KOH V. S. were required $= 93.39\%$ Na_2HPO_4.

Phosphoric Acid.—1.4798 gm. of phosphoric acid diluted with water to make 100 cc. of solution.

10 cc. were used for each of the following determinations:

U. S. P. IX Method (with one change, namely, rejecting the first portion of the filtrate).

50 cc. filtrate required 5.55 cc. KCNS V. S.

$49.75 - (5.55 \times 2) = 38.65$ cc. KCNS V. S. $= 85.10\%$ H_3PO_4.

Silver Nitrate and Alkali V. S. Method, Methyl-red Indicator.

Proceed as stated under sodium phosphate.

Duplicate assays gave 40.25 cc. KOH V. S. $= 86.54\%$ H_3PO_4.

Neutralization Method with Mixed Indicator.

Use 100 cc. of 10% NaCl solution* instead of 100 cc. of distilled water and prepare neutralized dilution of mixed indicator as given under sodium phosphate. Divide into two equal portions. To one of these portions add 10 cc. of the phosphoric acid solution and titrate with KOH V. S. until the color matches that of the reserved portion.

In duplicate titrations 13.4 cc. KOH V. S. were required $= 86.43\%$ H_3PO_4.

Comments.

Of the three methods described the U. S. P. IX method is the most tedious one and is bound to give low results for reasons stated in the first article; of the other two methods the one using methyl-red will give the best results working with unknown samples and unknown quantities; the mixed indicator method gives the quickest results but is influenced by the weight taken, the strength of the NaCl solution, the strength of the volumetric solution and, most seriously, by the deterioration of the indigo-carmine solution (a solution used for the experimental work in June was unfit for use in

*Interpret % NaCl solution as grams per 100 cc.

early September). Using a fresh indigo-carmine solution and paying attention to the other factors mentioned, very satisfactory results are obtainable. From the work described in this and the preceding paper the following tabular arrangement shows the conditions for obtaining the best results with the mixed indicator.

Phosphoric Acid:

Weight taken	NaCl solution*	Volumetric solution
about 1. gm.	7.5%	$\frac{N}{2}$
" 1. "	10. %	$\frac{N}{5}$
" 0.1 "	10. %	$\frac{N}{10}$

Sodium Phosphate Dried. Residual Titration:

Weight taken	NaCl solution*	Volumetric solution
about 1. gm.	2.5%	$\frac{N}{2}$
" 1. "	1. %	$\frac{N}{5}$
" 0.2 "	unnecessary	$\frac{N}{10}$

*Interpret % NaCl solution as grams per 100 cc.

Chemical Laboratories, Philadelphia College of Pharmacy and Science, September, 1922.

ETYMOLOGY AND PHARMACY.*

By Charles H. La Wall, Ph. M.

If, as has been said by an eminent scientist, "Life is a resultant of various opposing and co-ordinating forces," it is equally true that every branch of human study and endeavor which has come down from remote ages is an interesting complex of influences, many of which have long since disappeared and been forgotten.

This is particularly true of pharmacy, which is one of the most ancient of the arts and which, in its present state, may be likened

*Read before the 1922 Meeting of the Pennsylvania Pharmaceutical Association.

to a mighty river which has been formed by the confluence of smaller tributaries and streams, some of whose tiny rivulets have all but dried up and disappeared.

Etymology and pharmacy are not directly connected, it is true, but if the origin and histories of the names of things in one of the subdivisions of pharmacy are traced, however briefly, a wealth of material is opened to view which might be pursued further with profit and interest.

Let us pursue this course with reference to our systems of weights and measures. The word "avoirdupois" is of French origin and comes from the words "avoir," to have, and "pois" weight. The word "Troy" is also of French origin, but in this case the application is less direct. "Troyes" is the name of a French town, which was an important commercial center some centuries ago. This was at a time when coins were so frequently clipped or diminished in weight by the sovereigns who issued them as a substitute for a more direct taxation, that they no longer passed for face value, but had to be weighed. The standards of weight for this purpose, which originated in the French city of Troyes, were so satisfactory and so frequently referred to that they became widely adopted for weighing precious metals and later were made applicable to medicines.

The word "metric" comes from the Greek "metron," to measure.

Now taking up the subdivisions of these three systems and beginning in reverse order of their previous consideration, in the metric system, the word "metre" comes from the same root as "metric," the word "litre" comes from a Greek word "litra," signifying a unit of weight in use in ancient times and sometimes translated "pound."

The word "gram" also comes from an ancient Greek weight, "gramma," in use in early times.

The ounce, which is a unit common to both Troy and avoirdupois, is from the Latin "uncia," a twelfth of a pound or a twelfth of a foot, as the case might be, and is from the same root as the word "inch," which is somewhat further removed in its resemblance.

The drachm is from the Attic (ancient Greek), "drachma," a small silver coin often actually used as a weight.

The word "grain" is from the Latin "granum," a small seed or kernel, and was originally the kernel of wheat, as ancient English statutes reveal.

The pound is from the Latin "pondo," meaning weight. The scruple is also from the Latin, the word "scrupulus" meaning a small stone, and in its original tongue the term was used to denote fractional parts of time, measures of length, area, etc.

The pennyweight is from the English and was actually the weight of the coin called the "penny," as established by one of Britain's former rulers.

Taking now the measures of volume, the gallon is from an old French word, "galon," meaning a large bowl. The pint is of dubious etymology. Apparently it comes from the Spanish "pinta," which is a term derived from the Latin "pictus," meaning marked or painted and probably indicates a marked subdivision of a large vessel.

The word "drop" comes from the Anglo-Saxon "dreopan," from which root we also get the commonly used word "drip."

The minim is from the Latin "minimus," literally the smallest.

Of the fourteen commonly used terms outlined in the foregoing brief article we have represented Greece, Italy, France, Spain, Saxony and England and the composite character of our art becomes evident.

ABSTRACTED AND REPRINTED ARTICLES

PHARMACEUTICAL CHEMISTRY.†

By Frank R. Eldred.*

The complexity of the problems of life in health and disease is a serious limiting factor in the progress toward more efficient remedial agents. The important advances in this field have usually resulted from the work of many individuals trained not only in chemistry but also in the various branches of biology and medicine. Chemical studies undertaken with no thought of their bearing upon the treatment of disease often supply the foundations for the development of most valuable medicinal products.

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*Eldred & Atkinson, Inc., Chemical Advisors and Engineers, New York, N. Y.

In an attempt to inventory our progress in medicinal chemistry we are confronted by a vast number of individual researches which contribute directly or indirectly to our knowledge of disease and its treatment by chemical agencies. Progress is probably more rapid than at any previous time, owing to the widespread interest in the subject and to the application of newly discovered chemical principles; nevertheless if we had some adequate means for co-ordinating the work of the army of clinicians, pharmacologists, biologists, and chemists upon whose researches the health and happiness of the human race are so largely dependent, the rate of progress would be increased many fold. Any lack of co-ordination and co-operation in the attack upon disease constitutes a tragedy many times re-enacted.

An example of the time that may elapse between the synthesis of a new compound and the discovery of its physiological properties is afforded by the anti-oxime of perillaldehyde, which was prepared in the laboratory of a German chemical plant in 1910 and nine years later was made the subject of a Japanese patent on account of its sweetening power, which is said to be from four to eight times as great as that of saccharin.

It is consequently difficult to evaluate the progress in this field during any definite period or to give credit to those whose work may lead to most important discoveries. In the limits of this brief review no attempt has been made to give complete references or credit for progress to which many workers have contributed.

During the last two years there has been the usual flood of new remedies, but comparatively few of these represent real progress while many of them are distinctly inferior to products already available.

In many instances there is a marked tendency to return to older forms of medication, which have in the meantime been largely replaced by newer remedies or "pure principles." Some of the so-called pure principles fail to represent the activity of the crude product from which they are derived, thus disclosing the need for further knowledge of the chemistry of the parent product as well as of the substances that can be prepared from it. This is especially true of the crude vegetable drugs, since in the preparation of "pure" plant principles, physical and chemical changes take place, with the resulting destruction of the original colloidal complexes and accompanying changes in the solubilities of active constituents and their ab-

sorption when administered to animals. John Uri Lloyd was a pioneer in pointing out these facts and has made many valuable observations upon the colloidal nature of plant constituents. His original studies, published in the *Proceedings of the American Pharmaceutical Association*, 1876-1889, are very interesting in the light of recent developments.

Digitalis offers an excellent example of the failure to isolate substances which fully represent the physiological activity of the plant. Probably no drug has a more voluminous literature than digitalis, which has been the subject of extensive researches by Schmiedeberg, Kiliani, Cloetta, Kraft and many others. Cloetta[1] now reports the isolation of pure crystalline digitoxin which differs from any of the previously prepared digitoxins, all of which are considered by Cloetta to be impure mixtures. Pomeroy and Heyl[2] suggest the ready hydrolysis of digitalis principles as an explanation of the varying results obtained in the investigation of the drug, and also call attention to the observation of Tschirch that, while acetone removes the entire activity from digitalis leaf and its aqueous extracts, the acetone extract does not represent the entire activity of the drug. Extraction of an aqueous extract by chloroform resulted in a loss of more than half of the total activity. Tschirch believes that the activity of digitalis is due to the mutual effects of the various glucosides and is not the simple sum of the activity of the individual glucosides. Powdered digitalis leaf and a tincture or infusion prepared from it are probably the best forms for the administration of digitalis, notwithstanding the years of research which have been devoted to this drug. This is also true of many other vegetable drugs which are imperfectly represented by the constituents that have been isolated or from which no active principle has been separated.

Although there is a vast accumulation of data upon the composition of plants, we know very little about the exact physical condition and chemical composition of the substances as they exist in the plant cell before any changes have taken place. The methods which Osborne and his co-workers[3] applied in the investigation of fresh spinach and alfalfa would undoubtedly yield valuable results if employed in the analysis of vegetable drugs.

[1] *J. Chem. Soc.*, *120*, I (1921), 39.
[2] *Am. J. Pharm.*, *92* (1920), 394.
[3] *J. Biol. Chem.*, *42* (1920), 1; *49* (1921), 63.

Cod-liver oil, always popular with the laity, had for a long time been neglected by the medical profession until it was found to be very rich in vitamin-A. Since this discovery was made its use has been constantly increasing and its properties have been generally ascribed to its vitamin content. It has been shown to have a marked effect upon the calcium metabolism, but this property is probably not due to vitamin-A, since cod-liver oil is much more effective than butter fat in preventing rachitic conditions, even when the latter is added to the diet in sufficient quantities to supply much more than the normal requirement of vitamin-A.[4] It has also been reported that cod-liver oil retains its anti-rachitic properties after the destruction of vitamin-A by exposure to heat and air. It is probable that the physiological effects of cod-liver oil are due in part to its unsaturated fatty acids and its iodine content. It is interesting to note that the American Relief Administration in Russia is supplyng cod-liver oil to many day nurseries and children's homes.

Chaulmoogra oil which has been used for many years in the treatment of leprosy with indifferent success has acquired new interest since the preparation of the ethyl esters and sodium salts of the unsaturated acids has made it possible to administer the remedy intramuscularly. Brilliant results are being obtained and the treatment seems to be specific in leprosy.

The administration of substances by inhalation for their therapeutic effects was suggested by the studies of war gases and in some cases this may prove to be a valuable means of treatment. A rather crude attempt is the proposed treatment of tuberculosis by the inhalation of finely divided calcium carbonate. James Todd[5] has made interesting experiments on the treatment of infected animals by inhalation of ozonized air, and has followed this, with the co-operation of physicians, by the treatment of human cases of tuberculosis and other germ diseases with ozonized oils.

The physiological effects of benzyl alcohol and its esters were studied by Macht, who found that they had a relaxing effect on smooth muscle. Together with the known benzyl esters, a number of new benzyl compounds having the typical benzyl effect have been utilized with success in the treatment of many conditions where a sedative action on smooth muscle tissue is desired.

[4] *Ibid.*, 50 (1922), 5.

[5] "Experiments with Oxygen in Disease," Pittsburgh, Pa., 1921.

The relative toxicity of a number of alcohols has been determined by Macht,[6] who found an increasing toxicity in the series methyl, ethyl, propyl, butyl, and amyl. The secondary alcohols were less toxic than the corresponding primar alcohols. Kamm[7] tested the normal alcohols on *Paramecia* and reduced his results as well as those of Macht to the numerical expression $1 : 3 : 3^2 : 3^3 : 3^4$- -, the molar toxicity of any member of the series being three times that of the preceding member.

Pure isopropyl alcohol is now available in such quantities that it can be used, where applicable, as a substitute for ethyl alcohol. Although more poisonous than ethyl alcohol, it is also more active as an antiseptic and it might therefore replace ethyl alcohol where used for its preservative action.

Denatured alcohol is finding wider use in the manufacture of medicinal products and in the interest of economy its use will no doubt be further extended.

The autoxidation of ethyl ether, with the formation of ether peroxide, hydrogen peroxide, aldehyde, and acetic acid, which is described by Clover,[8] may have an important bearing on its use as an anesthetic. The oxidation is greatly accelerated by light.

A number of dyes, particularly the acridine dyes, find a continually increasing use as antiseptics. Further studies in the acridine series have led to the preparation of 2-ethoxy-6, 9-diaminoacridine, which is said to be superior to the acridine compounds now in use. A number of other dyes have been found to be active germicides. Mercurochrome, dibromo-oxymercury-fluorescein, seems to be a very useful urinary antiseptic and Hirschfelder[9] has found the mercury compounds of saligenin and of *p*-hydroxy-*m*-nitrophenyl carbinol to be effective as antiseptics. Johnson and Lane[10] have prepared several new derivatives of resorcinol, and have found that the phenol coefficients of the series, *viz.*, resorcinol, ethyl resorcinol, *n*-propyl resorcinol, *n*-butyl resorcinol, increase in the following order 0.3, 1.5, 4.3, 8.0. This observation will be of value in future work on antiseptics. The comparative toxicity of germicides to bacteria of dif-

[6] *C. A.*, *15* (1921), 122.
[7] *Science*, *54* (1921), 55.
[8] *J. Am. Chem. Soc.*, *44* (1922), 1107.
[9] *Ibid.*, *42* (1920), 2678.
[10] *Ibid.*, *43* (1921), 348.

ferent species, or even different strains, is not constant. The application of this "specificity of disinfectants" to the practical testing and use of germicides was first emphasized by Walters.[11] It has been found that even the various chlorine disinfectants differ greatly in their relative toxicity to various organisms. Attention is called to the efficiency of steam-distilled pine oil in killing *B. typhosus* and the high resistance of *M. aureus* and *B. anthracis* to this agent.[12]

Cymene and piperitone, a constituent of certain eucalyptus oils, may serve as sources for the commercial production of thymol, one of the valuable remedies in hookworm infections. Carvacrol has been found to be fully as effective as thymol, and since it can be readily prepared from cymene, it should find extensive use. Chloroform and carbon tetrachloride have also been successfully used in hookworm infection.

Cinchophen continues to increase in popularity and a number of closely related compounds have been placed on the market. Bogert and Abrahamson [13] suggest that a new thiazole derivative which they have prepared, 2-phenylbenzothiazole-6-carboxylic acid, may, from its analogy to cinchophen, have similar physiological properties.

A number of new barbituric acid derivatives have been prepared and some of them have been placed on the market, but barbital seems to be fully as efficient as any of the newer derivatives. Luminal has been found particularly valuable in epilepsy.

The organic arsenic derivatives are the subject of much important research. Arsphenamine and neoarsphenamine remain as the most valuable remedies in syphilis, although promising results have been attained with some of the newer compounds. Much progress has been made in the methods of manufacturing and testing arsphenamine and neoarsphenamine, and products less toxic than the original imported products are now available. Stieglitz and co-workers [14] have prepared 5,5′-mercuri-bis-3-nitro-4-hydroxyphenylarsonic acid and are continuing the investigation with the object of producing a compound for therapeutic use containing both arsenic and mercury.

Bismuth, administered intramuscularly, in the form of potassium and sodium tartrobismuthate suspended in oil or bismuth and am-

[11] *Am. J. Pub. Health, 7* (1917), 1030.
[12] *U. S. Dept. Agr., Bur. Chem., Bull. 989* (1921), 11.
[13] *J. Am. Chem. Soc., 44* (1922), 826.
[14] *Ibid., 43* (1921), 1185.

monium citrate in aqueous solution, is reported to act as a specific in syphilis.

Extensive researches have been devoted to the cinchona alkaloids. Jacobs and Heidelberger have prepared many new derivatives in the cinchona series with the object of finding compounds that will have a specific action in pneumonia. Through the studies of Bass, the quinine treatment of malaria has become much more effective, but it is not improbable that some new derivative of the cinchona alkaloids will be found which will be even more efficient than quinine. An alkaloidal product from *Lobelia inflata* prepared by a patented process is now on the market. Wieland,[15] who studied the alkaloids of lobelia, isolated two crystalline alkaloids, lobeline and lobelidine. These alkaloids will probably be useful theapeutic agents. Cushy has made the interesting observation that *l*-hyoscine is fifteen to eighteen times as active as *d*-hyoscine as a mydriatic, but that the two forms are identical in their action on the central nervous system and therefore in their production of "twilight sleep."

Karrer [16] and co-workers have prepared a number of new amino alcohols and cholines, some of which have an action on the uterus similar to that of ergot. Shepherd's purse (*Capsella bursa-pastoris*), which was used during the war as a substitute for ergot, has been found to contain choline and acetylcholine; the presence of tyramine is regarded as probable and that of histamine doubtful.

The manufacture of digestive enzymes from animal sources has been carried on chiefly for medicinal preparations but they are now being used in increasing quantities in the food, leather and textile industries.

The use of gland extracts in medicine is rapidly increasing and valuable contributions are being made to our knowledge of the composition of these extracts. Notable among such studies is the work of Kendall on thyroxin, the active substance of the thyroid gland. A concentrated preparation of the internal secretion of the pancreas is said to have been used with remarkable success in cases of diabetes. The active principles of the pituitary have not yet been determined, although much progress has been made by Abel, Dale, Dudley and others. Drummond and Cannan [17] state that tethelin

[15] *Ber.*, *54* (1921), 1784.
[16] *J. Chem. Soc.*, *210*, 1 (1021), 228.
[17] *C. A.*, *16* (1922), 1974.

is an impure mixture of lipoids, and that the anterior lobe of the pituitary does not seem to influence growth. Ovarian and placental extracts have been found very useful in disturbances of menstruation and pregnancy.

Vitamins are to be considered from the standpoint of foods, as cod-liver oil and certain yeast preparations are the only useful vitamin-containing products that can be classed as medicines. It is possible that with further knowledge of the functions of vitamins and their separation from plant and animal products, vitamin preparations will become valuable as medicines.

McClendon [18] has suggested that our use of refined table salt is a mistake, and that it might be well to substitute a sterilized sea salt which would supply not only iodine, but also numerous other elements which may be deficient in the diet.

The relation of calcium metabolism to rickets has been the subject of much study. Sunlight has been found to have an effect similar to that of cod-liver oil on rachitic animals. Mason states that calcium chloride is better absorbed than calcium lactate and it is interesting to note that a single dose of cod-liver oil administered with the lactate seemed to increase the absorption of calcium.

Colloidal metals have been used, in many cases with apparent success, in combating various infections. Colloidal antimony is reported as being very efficacious in the treatment of leprosy.

Corresponding to the toxic relations between arsenic and arsenious acids, the ions of selenious and tellurious acids have been found to be much more effective in killing bacteria than the ions of selenic and telluric acids. Germanium dioxide has been found to stimulate the formation of red blood-cells.

Viewing the manufacture of medicinal products from an industrial standpoint, small-scale operations are the rule and engineering and factory practice is frequently not up to the standard required for larger operations. Much can be gained by a careful study of the methods employed in other branches of chemical industry where success is dependent upon progress in engineering and upon economical management.

[18] *Science*, 55 (1922), 358.

ADEPS HOMINIS: A RELIC OF PREHISTORIC THERAPY.*†

By Dr. M. A. Von Andel, Gorinchem, Netherlands.

One of your illustrious countrymen, Sir James Mackenzie, whose masterly treatises on practical medicine have contributed so largely to enhance the reputation of English clinical science and art on the Continent, in the preface to his work on "The Future of Medicine," describes our art as evolving slowly out of a past, in which facts and fancies, faiths and beliefs, and many superstitions were strangely commingled. Assuming, as we are entitled to do, that medicine has watched over the cradle of mankind, and that there may even have existed an instinctive embryonic sort of medical knowledge before the appearance of man in his present form, we need not be surprised that an art transmitted from such a past has retained down to our own times, vestiges of that remote antiquity, as, analogously, the rudimentary organs of men and many animals preserve the marks of their primitive ancestors.

Survivals.

It would appear, then, that the origin of such relics of the past reaches back to a period prior to that which the history of medicine covers, since it pertains to a stage in the development of the mental faculties of mankind, when emotions, belief, and science had not yet differentiated, and existed only as amorphous germs in the chaotic mass of primitive conceptions. Therefore, these vestiges present themselves to us as transmissions from the dawn of human intelligence, and accordingly may be of service in the study of the depths and intuitions of the untrained mind of our contemporaries which is on a level with that of primitive man. Such survivals generated from the prevailing beliefs of a rude and barbaric society, have lingered on and permeated the official science of later ages, retaining their vitality and authority until finally discredited by the progress of research and the growth and development of rational opinion. Nevertheless, even when officially condemned and refuted by their former patrons, these superstitions have persisted amongst

*Paper read before the Section of Pharmacy, Third International Congress of the History of Medicine, London, July, 1922.

†Reprinted from *The Pharmaceutical Journal and Pharmacist.*

those classes of the population who are still firmly attached to old-fashioned beliefs and customs, or whose mental faculties are not far enough developed to understand, or to value the rationale and results of scientific research, and who, on this account, are at the mercy of the obscurantist sentiment and practice of their class. We shall find that a great number of medicines, and especially those of an animal nature, owe their reputation to factors that seem worthless to us, but nevertheless regard for these factors has excited a powerful influence in keeping alive faith in such remedies, and in perpetuating the use of them which goes back to the childhood of the race, in an age earlier even than that computed by the German medical historian, Höfler, who explains such superstitions in medicine as survivals of ritual sacrifices.[1] It is the object of this paper to adduce evidence in support of the probability of this doctrine from an example occurring in present-day folk-medicine, although it may not be possible to give a definitive solution of so intricate a problem.

Unguentum Adipis Hominis.

Among the many ointments of animal origin in present-day use in Dutch folk-medicine, one reported to contain human fat still enjoys a certain vogue as an application for dislocations and lameness. It usually goes under the name of "Hangman's Salve," or "Poor Sinner's Fat." As, however, capital punishment was abolished in the Netherlands over seventy years ago, there is very little chance of the confiding customer getting the genuine article. What he is likely to receive is a very little portion of suet in a tiny box, and so to fare no better than the hero in the tale of Heinrich Seidel, who sought in vain for gnat's fat to which thaumaturgic therapeutic properties were ascribed. In former times, however, such a miscarriage of *quid pro quo* in the transaction seldom took place. For, in the eighteenth century, genuine *adeps hominis* was still regularly stocked in the apothecaries' shops. One of my compatriots, describing and denouncing the abuses with which the apothecaries of his time were charged, and, in particular, their tendency to trespass on the territory of medical practice, inveighs against them for selling the most revolting compounds, including ointments containing parts of venomous animals, and even human fat,[2] but that denunciation was far from being just, because human fat was on the list of "simples" in the official dispensatories of that date.

Cures Ascribed to Human Fat.

It will suffice to specify two cases in which human fat was believed to have miraculous powers. A popular author of the seventeenth century relates that a soldier, who was transfixed by a spear, recovered completely from what else had proved a fatal wound by taking as a vulnerary, a mixture of human fat, blood of a he-goat, and Benedict water in beer,[3] and an ointment consisting of human fat, dog's fat, and the marrow of a horse-bone was recommended as a sovereign remedy for cramps. These ointments seem to have been in common use, since Vesalius, giving directions for the boiling of the bones of a corpse in order to prepare a skeleton, includes an injunction that the fat floating on the surface of the water should be carefully collected as the fat is held in high esteem as an excellent ointment for wounds, and to restore the functions of tendons and nerves.[4]

Sources of Supply.

The opportunities of obtaining supplies of human fat were not confined, however, to the boiling of corpses for skeleton-making. It was also obtained from the corpses of healthy, vigorous persons who had come to a violent end, that being a *sine qua non* for the medicinal value of the fat. Cabanes records that in 1572, during the massacre of St. Bartholomew at Lyons, the bodies of the fattest victims were delivered to the apothecaries, who extracted the fat from them,[5] and a similar incident occurred in the history of my native town, Gorinchem, in South Holland. About the date of the massacre of St. Bartholomew the insurgents, or water-beggars as they called themselves, having raided the town, which up to that time had been loyal to the King of Spain, captured about twenty monks, and carried them off to Brielle, where the prisoners were tortured and put to death. The mob treated the corpses of the victims in the most hideous manner. The bodies were cut open, hung on ladders, like the carcases of pigs, and the fat collected and afterwards sold at Gorinchem presumably because that was the place of origin of the commodity.[6] Apart from these special cases, other sources of supply were provided by military operations. In Motley's "History of the United Netherlands," we read that during the siege of Ostende (1601), after each engagement, the Dutch surgeons sallied forth over the stricken field and brought back well-filled bags of human fat,[7] and Johann Dietz, a surgeon who took part in the battle of Ofen

(1686) tells us in his Reminiscences that the bodies of the Turks slain in the battle were flayed, the fat boiled out, collected in big bags, and conveyed to the camp of the conquerer.[8] Another fairly regular, although not abundant, source of supply was the bodies of executed criminals, the fat of which was the perquisite of the executioner, who sold it to, and even treated patients with it, thus becoming an unwelcome competitor with the apothecaries and the medical practitioners. In his "History of Pharmacy in Cologne," Alfred Schmidt states that in 1584 the doctors and surgeons of Eger protested against the leave given to the executioner to melt out the fat of his "subjects."[9] Another and even more gruesome source of supply was from the slowly-mouldering bodies of criminals exposed on stakes. In that case, as a Dutch author informs us, the simplest method was to place vases under the heads of the bodies. Human fat was the principal ingredient in the famous salve with which the executioner dressed the dislocated limbs of the miserable beings who had been subjected to torture.

The Surgeon-Executioner.

This curious conjunction of surgeon-executioner was by no means uncommon in the Netherlands, and with the connivance of the authorities, the dual function survived until the middle of the eighteenth century.[10] In other countries the repute of the executioner and his marvellous salves seems to have been no less prevalent and persistent. In the memoirs of the French Napoleonic soldier, Sergeant Francois Burgogne, an account is given of an untoward incident in which the executioner and his salve played a disconcerting part. Arriving after a fatiguing march at a small Spanish town, Burgogne and his comrades asked their billet-host, an aged bachelor, to procure them some butter or other fat to prepare their meal. He expressed with regret his inability to do so, but, in his absence the soldiers, in searching through the house, came upon three small boxes containing fat, which they "commandeered," and used with their meagre meal of beans. On the return of their host the soldiers took him to task for his inhospitableness, only to learn to their consternation and horror that they had been swallowing human fat which

their landlord, who was the local executioner, had in stock for ointment-making. Even as late as the end of the eighteenth century, during the French Revolution, the fat of the victims of the guillotine was in demand, and Cabanes states, on the authority of de Balzac, that in his time the aristocrats of Sanson sold little boxes of suet to the applicants for "graisse de supplicie." [11]

A Suggested Rationale.

From the foregoing examples, it is evident that most store was set on the human fat taken from the bodies of persons who had suffered a violent death, and a similar principle runs through the greater part of folk-medicine, in relation to remedial substances of human origin. Therapeutical powers have been vulgarly ascribed to nearly every part or excretion of the human body, and a poetical German apothecary of the eighteenth century has enumerated twenty-two different remedies derived from this source.

It is impossible, within the limits of this paper, even to attempt to prove that the principle of the magical powers of the substances or products of a young and healthy body underlies and actuates similar beliefs and customs of world-wide range. Two typical examples must suffice. These are not strictly medical, but have an evidential value: (a) The salves with which the witches anointed themselves in preparation for the "Witches' Sabbath," in addition to the narcotic herbs, which induced hallucinations, contained the fat of young children, which was believed to have the property of transferring to the witch the vitality and youthfulness of the child from whom it had been taken. This superstition of bygone times finds a parallel in the belief that the fat exuding from the corpses of saints and martyrs possessed miraculous healing powers—*e. g.*, the miraculous oil produced by the corpse of the Abbess Maria van Volckenisse Oerschot, in North Brabant.[12]

As the latter example shows, even at the present time folk-medicine retains some of the superstitions which formerly had a place in orthodox medicine. These superstitions had their genesis in the crude conceptions by which the awakening mind of primitive mankind tried to explain the phenomena of Nature. One of the first forms in which the religious sense reveals itself is derived from and moulded by the feeling that there exists a mysterious interpenetrat-

ing force, manifesting in multitudinous modes, and in such grand categories as energy, vitality, beauty, and sublimity. This mysterious power, which is regarded as partly physical and partly spiritual, is generally denoted by its Melanesian name of "Mana," as it is in Melanesia that the idea exists in its purest form, but a Dutch anthropologist has suggested for it the alternative name of "Soul Subtance."[13] It is conceived of as being bound to and part of all sorts of objects and creatures, and in order to assimilate the desired properties of these objects and creatures, the devotee of primitive magic strives to bring them into external or internal contact with himself, so that he may acquire the vitality, health, or other virtue of the original. On this theory the apparently arbitrary use of many remedial agents of animal origin may readily be explained and classified.

It would be a formidable undertaking to retrace the lines of such a custom back to their primitive sources, as they have found their way down to the present by devious and obscure channels, since, in his lecture on "Early English Magic and Medicine," our President, Charles Singer, distinguished no less than eight elements which contributed to the medical lore of our Anglo-Saxon ancestors, I despair of discovering the true historical sources of contemporary folk-medicine.

In regard to the explanation of the survival of archaic conceptions and practices in medicine, the subject of this paper is of secondary importance. I agree with the folk-lorist Marett that the custom herein described, which has persisted over such a long period, whatever may be its origin, is likely to conform to a given popular standard of mental development. On this ground alone, customs of this type have a psychological interest, as well as a historical value. It is idle to expect to discover what is at the back of the belief or custom by catechising the believers in it. The mental processes and manifestations of the primitive intelligence present the character more of a collective mental reflex than of a distinct personal expression, and are governed chiefly by the hereditary semi-conscious conceptions and instinctive sensations of the group to which they belong, and these are prepotent over the objective observation and interpreta-

tion of the facts. This state of mind, distinguished by Lévy-Bruhl as *mentalité prélogique*,[15] at present still governs the subjective life and external conduct of a majority of our fellow-citizens. Hence it is that the facts and fancies of folk-medicine deserve to be investigated alike as a form of the palæontology of human culture, and as subjects suitable for the elucidation of the reactions of the primitive and untrained mind to phenomena which modern medical science seeks to rationalize.

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14. Alb. Kruyt: *Het Animisme in den Indischen Archipel.* s'Gravenhage, 1906.

15. L. Levy-Bruhl: *Les Fonctions Mentales dans les Sociètès Inférieures. Bibliothèque de Philosophie Contemporaine.* Paris, 1918.

SCIENTIFIC AND TECHNICAL ABSTRACTS

Preparation of Alkaloidal Mercuric Iodides in a Crystalline Condition. M. François and L. G. Blanc. Comptes rend., 1922, 175, 169-171.—The amorphous precipitate obtained by adding potassium mercuric iodide to a solution of an alkaloidal salt can be brought into solution by warming it whilst suspended in the mother liquor with a large excess of hydrochloric acid; on then allowing to cool slowly it is usually re-deposited in a crystalline form. In the actual preparation of these crystals, the initial precipitation may be avoided by slowly mixing equal volumes of warm solutions of the alkaloidal salt containing a large amount of hydrochloric acid, and of potassium mercuric iodide, of suitable concentrations. A clear solution will be thus obtained from which the alkaloidal mercuric iodide is deposited in crystals on slowly cooling. In this way the mercuric iodides of caffeine, theobromine, quinine, morphine, codeine, cocaine, strychnine, pilocarpine, and sparteine, and also of quinoline, were prepared. They form brilliant yellow crystals, containing no chlorine and no water of crystallization. They show a tendency, well marked in the case of the caffeine compound, but scarcely perceptible with the less soluble compounds, such as that of quinine, to be decomposed by water into mercuric iodide and the alkaloidal hydriodide.—Through *Chemical News*.

G. F. M.

Potency of Commercial Vitamine Preparations.—E. V. McCollum and Nina Simmonds, of Johns Hopkins University (*Jour. Am. Med. Asso.*, 1922, lxxviii, 1953-1957), have tested six commercial vitamine products for vitamine B. Young rats were used as experimental animals; they were given a restricted basal diet for several weeks, then received the same diet plus a commercial vitamine preparation for an additional period of several weeks. The growth curve of each rat was determined. The rats usually gained in weight but little if at all during the administration of the vitamine preparations. The deduction is made that the commercial preparations did not contain vitamine B in concentrated form. McCollum

and Simmonds recommended that milk and leafy vegetables be used to supplement the deficiencies in the ordinary diet and to insure an adequate supply of vitamines. Salads should be eaten twice daily. A liberal helping of greens and a quart of milk or its equivalent in the form of manufactured dairy products should also be taken daily. —Through *Journ. of Franklin Institute.*

J. S. H.

Toxicity of Germanium.—The rare element germanium lies next to arsenic in the periodic system. The relative toxicity of these two elements is therefore a matter of interest. F. S. Hammett, J. H. Muller and J. E. Mowrey, Jr., of the University of Pennsylvania (*Jour. Pharm. and Exp. Therapeutics,* 1922, xix, 337-342), have studied the relative toxicity of germanium dioxide and arsenious oxide when administered subcutaneously to albino rats. Arsenious oxide usually produced fatal results when given in a dose of 8 millegrams per kilogram of body weight; sublethal doses caused sloughing at the point of injection. Germanium dioxide in doses as great as 180 millegrams per kilogram of body weight produced neither death nor any apparent evidences of harmful effect; sloughing did not occur at the point of injection. With respect to toxicity, germanium resembles the tin group rather than the arsenic group of elements.—Through the *Journ. of Franklin Institute.*

J. S. H.

MEDICAL AND PHARMACEUTICAL NOTES

Commercial Acetylsalicylic Acid. M. V. del Rosario and P. Valenzuela. (*Philippine J. Sci.,* 1922, 20, 15-22.)—Eight samples of commercial aspirin of German and American manufacture were found to vary in their crystalline form, color and odor, while the melting points ranged from 127° to 136° C., and the percentages of ash from 0 to 0.059. No sample showed the melting point 135° C. given by the Pharmacopœia Germanica; the British Pharmacopœia accepts 133° C. With the odorless samples, that is, those free from appreciable dissociation, the melting point was 136° C., but this was obtained also with samples having an aromatic odor related to

neither acetic nor salicylic acid. Some of the samples when dissolved in alcohol required more than the theoretical proportion of 0.2 *N* sodium hydroxide for neutralization, and in other cases more of the alkali was saturated if the neutralized solution was rendered alkaline and boiled under a reflux condenser. The percentages of free acetic and salicylic acids varied from 0.011 to 0.026 and from 0.002 to 0.015 respectively. If well washed, aspirin should be free from sulphate and chlorine ions; and if it is crystallized from a solvent other than water, its melting point will approach that of the pharmacopœias and the tendency to undergo hydrolysis will be minimized.—Through *The Analyst.*

T. H. P.

OXALIC ACID IN FOOD.—In the "Queries and Minor Notes" columns of the *Journal of the American Medical Association,* the following figures are quoted in reply to a correspondent who asked: What foods contain calcium oxalate. Calcium oxalate, says the *Journal,* is the usual form in which oxalic acid appears in the diet. The amount of oxalic acid in different articles of food, in parts per thousand, as determined by Esbach, is:—

Black tea infused five minutes ..	2.060
Cocoa-powder	3.520 to 4.500
Pepper	3.250
Coffee	0.127
Parsley	0.006
Common beans	0.158
Potatoes	0.046
Wheat bread	0.047
Crust	0.130
Buckwheat flour	0.171
Barleymeal	0.039
Maize flour	0.033
Sorrel	2.740 to 3.630
Spinach	1.910 to 3.270
Rhubarb	2.466
Brussels sprouts	0.020
Cauliflower	0.003
Beetroot	0.390
Tomatoes	0.002 to 0.052
Carrots	0.027
Chicory	0.103
Endive	0.017

Lettuce	0.016
Dried figs	0.270
Currants	0.130
Prunes	0.120
Gooseberries	0.070
Plums	0.070
Raspberries	0.062
Oranges	0.030
Lemons	0.030
Cherries	0.025
Strawberries	0.012

—*Journ. Amer Med. Assoc.*, July 22, 1922, 321.

The Analysis of the Urine as a Part of the Physical Examination of the College Student. By G. O. Higley, Ohio Wesleyan University.—This work was begun in 1915 because of the death of a college student from diabetes. Tests are made for sugar and for albumin, and in special cases, for other pathological substances. Each year a considerable number of cases of nephritis are discovered, of which about two-thirds show a previous history of an acute attack of that disease.

When any pathological substance is detected a second and often a third sample of urine is tested, and the student is advised to consult a competent physician and to report his findings to the college physical examiner.—Abstract of paper read at the 1922 Meeting of the American Chemical Society.

Less Than Drop Would Depopulate World.—Poison so powerful that all the people on earth could be killed by one-millionth of half an ordinary thimble full! Drs. Jaques Bronfenbrenner and M. J. Schlesinger, of Harvard University, have found that the strength of the botulinus toxin, which occurs in spoiled vegetable food, is so great that the average man would die from a dose of 0.00000000000000001 cubic centimeters of it.

As there are 473 cubic centimeters in a pint, only an infinitesimal amount would be required to swamp the immigration authorities in Heaven. One cubic centimeter would be enough to depopulate the whole earth with 999,999 parts left over.

Botulinus poisoning was first known as "sausage" poisoning and was detected after fatalities resulting from eating sausage, meats and fish. Recently, this poisoning has been more common after the eating of decayed vegetable foods. It is caused by the bacillus botulinus and, unlike the toxin of diphtheria or lockjaw, it is deadly poisonous when introduced into the body by way of the mouth.

Contamination of foodstuff producing this poison is not common and should such poisoning be present it is usually readily detected by the putrid odor of the food. If the poisoned food is boiled, it ceases to be harmful, while even when the poison is actually consumed, nature and an antitoxin may protect the individual. —Through *Science Service.*

Bleaching Foods With Sulphurous Acid.—Sulphur dioxide has always been considered effective in bleaching foods, but those manufacturers who use this bleaching agent have had great difficulty in removing all traces of the bleach after its work was done. The Government prescribes that food bleached in this way must contain no trace of sulphur. A process has now been patented which enables the manufacturer to use sulphur fumes for this purpose without encountering any difficulty in their subsequent removal. After the bleaching action is finished, enough hydrogen peroxide is added to remove all traces of sulphur dioxide still left in the food. This process can be applied with good results to the bleaching of cherries, gelatine, fruits, syrups, nuts, potatoes, apples and cereals.—From *The Industrial Digest.*

Solution of Sulphur in a Mixture of Carbon di Sulphide and Carbon Tetrachloride.—M. Serre, of Bordeaux, in order to reduce the inflammability of such a mixture, has worked out the following formula:

Powdered Stick Sulphur	10 gr. 40
Carbon di Sulphide	60 cc.

When solution is effected add carbon tetrachloride to produce 100 cc. and filter. The finely powdered stick sulphur has seemed to be more soluble than any other form.

If carbon tetrachloride is added to a solution of sulphur in carbon di sulphide, a portion of the sulphur is always thrown out,

whether the solution is saturated or not. In the above formula Serre has found the amount to be 0 gr. 40—hence he adds that amount at the start.—From *Bulletin de la Société de Pharmacie de Bordeaux*, through *Répertoire de Pharmacie*.

W. H. G.

Abnormal Toxicity of Certain Caffeines.—A number of samples of caffeine after examination in the Physiological Laboratory of Pharmacie Centrale, have been refused by that house on account of a toxicity above the average.

The manufacturers of these hypertoxic caffeines, when questioned, declared that they had "modified" their process. Desiring to find the cause of this hypertoxicity, this laboratory endeavored to ascertain what bearing the primary source or mode of extraction might have upon the question. Many substances containing caffeine (coffee, tea, tea-dust, kola nut, guarana) were used and several methods of extraction were employed, special attention being given to those used in the industry. All the caffeines thus prepared presented a normal toxicity of 0.24 Gm. to 0.0 Gm. per kilo of animal.

But all caffeines synthetically produced were found to possess hypertoxicity. This abnormal toxicity was laid on uric acid or purines of the same group. Caffeine and uric acid belong to two groups of purines, the first to the dioxy- the second to the trioxy-group.

The experiments in Pharmacie Centrale laboratory seem to prove that the abnormal toxicity of certain commercial caffeines is due to purine bases related to the uric acid group, the presence of which was, very truly, due to "modified" processes designed to augment the product and yield a substance having the physio-chemical, although not the physiological, properties of true natural caffeine.—From *Répertoire de Pharmacie*.

W. H. G.

Urinary Calculi Containing Silicon.—Urinary calculi are ordinarily composed of urates, oxalates, phosphates, carbonates of lime. Schlicht, in *Pharmaceutische Zeitung*, states that he has found calculi containing chiefly silicon in the bladder of a sheep.

He attributes this formation to feeding upon plants rich in silicon.

W. H. G.

Action of Saccharin Upon the Human Organism.—Since the appearance of saccharin in 1879, and its widely spread use as a sweetening agent in food products, numerous articles have been published which show great divergence of opinion concerning its innocuous nature.

M. Ed. Bonjean, member of The Superior Council of French Public Hygiene, has made a remarkable study of this substance. The result of M. Bonjean's experiments shows that the divergence observed amongst the scientific authors regarding saccharin is principally due to the *acid* action of *pure* saccharin; if this is neutralized by sodium bicarbonate in the manner in which saccharin is actually sold to the consumer, and future experiments carried on therewith, M. Bonjean thinks these divergences will cease. In combination with sodium, saccharin does not at all prevent fermentation—no more than the action of ptyalin, nor that of pancreatin and pepsin. Tablets of sodium-saccharin possess no bactericidal nor antiseptic properties. Ingenious physiological tests of long duration with men and dogs in all doses practically possible, have produced no derangement of digestion or of health. These experiments confirm once more the inoffensive action of sodium-saccharin upon the organism in general.—From *Gazette des Hopitaux*, through *Répertoire de Pharmacie*.

W. H. G.

Food and Drug Adulteration in Massachusetts.—A copy of the recently issued report of the State Department of Health covering the statistics of food and drug examinations in that State for the year ending November 30, 1920, affords interesting reading to the analyst. The report has been prepared under the supervision of Hermann C. Lythgoe, B. S., Director of the Division of Food and Drugs. Considerable space is devoted to milk, the methods of analysis having been carefully examined. Many analyses were made with a view of studying the value of the protein-fat ratio as an indication of adulteration, but it appears that this datum can only be used with several other factors. The amount of liquor submitted by police authorities was larger than in former years. The period covered by the report includes a portion of the period in which the Volstead Act was operative. As might be expected the greater number of samples were from cities. Out of over 1200 samples, 108 were classified as beer, 47 as cider, 165 as wine, 248 as whiskey, 207 as Jamaica

ginger, leaving 454 not specifically classified, but many of these were determined to be distilled liquors of some sort; the majority contained less than 1 per cent. of alcohol. In comparison with former years the samples of high alcohol content have been much more numerous, and distilled liquors have been more than double in proportion. Heavy alcoholic preparations such as ginger extracts and pure alcohol are now nearly four times the proportion formerly submitted.

An interesting case of an adulterated salad dressing is reported. The user called the attention of the department to it because it had produced a "physiologic action" (which is not specified in the report, but which was probably purgation). The nature of the adulterant was at once suspected; inquiry confirmed the suspicion, for it was found that a white mineral oil was being used instead of an edible oil. The fact led to an examination of many other samples, but only two manufacturers were found to be using the material and these promptly discontinued it and destroyed their old stock. A strike in the packing houses in the State led to a suspicion that adulteration of sausages might be practiced, and analysis confirmed it, many samples containing excessive proportion of flour or starch being found. Prosecutions put an end to the practice. Many soft drinks were found to contain saccharin. Attempts were made to attack the law in this case, but were unsuccessful.

Drug adulteration was not found to be extensive, less than 10 per cent. of the samples examined being found objectionable. Half of these were magnesium citrate. A good deal of the activity of the Division was devoted to controlling the cold-storage laws, and many prosecutions were brought under the acts relating to this subject.

The State Department has undertaken the manufacture of arsphenamin. Considerable improvement in the details of the process, especially in the ampouling, have been introduced with resulting economy in operation. Favorable reports from clinical work have been received. The principal expense is said to be the ampouling, which, it is thought, cannot be reduced below 15 cents per ampoule.

H. L.

BOOK REVIEWS

PROTEINS AND THE THEORY OF COLLOIDAL BEHAVIOR. By Jacques Loeb, Rockefeller Institute of Medical Research. McGraw Hill Co., Inc., New York, publishers.

This volume of two hundred and ninety-two pages is a most important contribution, of interest not only to those who are engaged in work on proteins, but also to students of the chemistry of colloids.

The author, by numerous experiments, shows that proteins are amphoteric electrolytes, which form ionizable salts either with acids or with alkalies, and that the behavior of the proteins in this respect is dependent upon the hydrogen ion concentration. There is for each protein a critical point of hydrogen ion concentration at which the proteins refuse to combine; but above this point, they combine with acids, and below, with alkalies, and, indeed, in stoichiometric ratios.

He discusses the swelling of gelatin, and of other proteins, the osmotic pressure, viscosity and other characteristics of their solutions, and reaches the conclusion that colloidal behavior is due to the phenomenon of aggregation which influences the diffusion of the ions and creates the condition referred to in the modern literature of colloidal chemistry as the "Donnan equilibrium," or the "Donnan effect," which, however, is not peculiar to colloids, but may be produced also when two solutions of crystalloids are separated by a membrane, provided one of the ions cannot diffuse through the same, thus creating potential differences and osmotic forces. Indeed, the book as a whole presents forcefully the conviction of the author that proteins are amenable to the general chemical laws.

While the whole scheme of experimentation recorded in this intresting volume was, no doubt carried out as a method of attack on problems in physiology and in pathology, the book is of great importance also to all who are interested in protein products—hence is of interest to the scientific pharmacist.

J. W. STURMER,
Dean of Science, P. C. P. & S.

THE STORY OF DRUGS, A POPULAR EXPOSITION OF THEIR ORIGIN, PREPARATION AND COMMERCIAL IMPORTANCE. By Henry C. Fuller, of the Institute of Industrial Research. Octavo, 343 pages with 85 illustrations. New York, The Century Co., 1922.

Do you realize how immense, how far-reaching, how romantic the drug business is? Are you fully aware what an important rôle drugs play in the health of the nations? The book before us tells the story in as interesting a manner as a novel. It reaches all the way over the known world from tropical India and its spices, to Turkestan and its wormseed, to South America and its many drugs, to the Blue Ridge Mountains and its roots and herbs, to Australia and its asthma weed and other drugs. Its subjects range from rouge and lip sticks to serums and vitamines, from chaulmoogra oil to Lydia Pinkham's Vegetable Compound, from the manufacture of gelatine capsules to the rôle of alcohol in medicine. The author discusses quite fearlessly some questions vital to the drug trade at this time. The book deals with materia medica, about which, we are sorry to say, a most unnecessary haze of ignorance has gathered among the public at large.

That in a book of this kind a few errors must necessarily creep in is perhaps excusable. Permit me to call attention to at least some: Cocaine was discovered by Dr. F. Gaedcke not Gardeke (p. 24). It was Dr. Friedrich Hoffmann, not Hoffman (p. 29) who prepared the celebrated anodyne as an opium substitute. Chile saltpeter does not contain KI (p. 11), but $NaIO_3$ as the chief iodine salt. Trees known as Peru and Tolu (p. 9). Resin of Canada balsam (p. 9). Balsam of Peru is a fragrant aromatic gum—resin (p. 156). Fluidextract of opium (p. 35). Fluidextract of vanilla (p. 47). It is to be regretted that belladonna *leaves* are used to prepare a type of fluidextract (pp. 47 to 49) as the fluidextract of belladonna root is the one which is official! We must oppose the statement that completely denatured alcohol can be used for bathing and rubbing (p. 83)! Emperor Frederic II did not issue his celebrated edict in 1233 (p. 21), but in 1224, the same year when the University of Naples was founded. It is not a credit to pharmacy that Fuller uses the chemical nomenclature for alkaloids as quinin, codein, etc. However the alkaloid of coca leaves is written cocaine! We hope that in a new edition these errors will be corrected.

This is the first, and so far the only, book of its kind concerned with the actual facts of the drug trade as it exists today. It is an unusual and fascinating book which will prove useful to many men of many minds. Surely pharmacists and others connected with the drug trade should read and study the work!

OTTO RAUBENHEIMER, Ph. M.

FREE PUBLIC LECTURE COURSE

1922—1923

Philadelphia College of Pharmacy and Science

145 NORTH TENTH STREET

The lectures will begin at 8.15 P. M.

First Lecture. Wednesday Evening, October 11, 1922.

CHEMISTRY AS AN AID IN THE DETECTION OF CRIME.

By Prof. Henry Leffmann, A. M., M. D.

Lecturer on Research, Philadelphia College of Pharmacy and Science; Hon. Professor Organic Chemistry, Wagner Free Institute of Science, Etc.

Chemical processes were early applied in the detection of poisons, and this branch of the science under the title of "Toxicology" still constitutes a most important department of forensic procedure. Of recent years the problem of food adulteration and forgery have become very complex and frequent, and chemical and chemico-physical methods have been applied with much success as well as in other phases of crime. The lecture will include experiments and illustrations of some of the features of this line of work.

Second Lecture. Wednesday Evening, October 18, 1922.

CORN AND ITS PRODUCTS.

By Prof. Freeman P. Stroup, Ph. M.

Professor of Chemistry, Philadelphia College of Pharmacy and Science.

To many people "Corn" means only something used for the purpose of fattening hogs; others think of it only in connection with "Corn Muffins" or "Corn Pone." To such, an account of the present utilization of the grain, the cob from which the grain has been "shelled," and the stalk which bore the "ears," is apt to be a revelation.

The lecture will include a bit of history of the plant, its growth and cultivation, and the uses of its various parts industrially and as sources of human and animal food, not forgetting the social features that sometimes accompany the harvesting of the crop.

In connection with the lecture, there will be displayed an extensive collection of specimens representing both natural and artificial products.

Third Lecture. Wednesday Evening, November 15, 1922.

THE STORY OF GLASS.

By Prof. J. W. Sturmer, Pharm. D.

Dean of Science, Philadelphia College of Pharmacy and Science.

An illustrated lecture on the glass industry; its growth from the dark glass-less age, to its present-day complexity and importance.

The glass window—how it has influenced our modes of living, and our various lines of employment.

Various types of glass and of glassware; their special uses in the common activities of life.

How glass is moulded and shaped and cut and ground and tinted and decorated. How to select glassware. How to care for it properly.

The lecture will be illustrated with pictures, slides, and with numerous specimens of interest.

Special attention will be given to the more recent developments, and to the newer uses of the various kinds of glass, both in the scientific laboratory and in the common activities of modern life.

Fourth Lecture. Wednesday Evening, December 6, 1922.

VITAMINES.

By Prof. David Wilbur Horn, Ph. D.

Professor of Physics and Physical Chemistry, Philadelphia College of Pharmacy and Science; Professor of Inorganic Chemistry, Wagner Free Institute of Science.

Historical sketch of the chemistry of diet. The experimental establishment of the Laws of Conservation of Matter and of Energy in diet. The inter-changeability of food factors. The protein mole-

cule and the amino acids. Porteins that suffice for normal life. Historical sketch of deficiency diseases. Catalysts, in general. The purification of foods and its effects. Experimental study of accessory food factors. Funk's mistaken "Vitamine." The general theory of Vitamines arising from Funk's error. The present status of Vitamines.

Fifth Lecture. Wednesday Evening, December 13, 1922.

BACTERIAL PREPARATIONS IN COMMON USE.

By Prof. Louis Gershenfeld, B. Sc.

Professor of Bacteriology, Philadelphia College of Pharmacy and Science.

Yeast, Bacillus Bulgaricus, and other bacteria sold as such for industrial and medicinal purposes.

Preparations made with bacteria as a starting point.—Of considerable value in industries and in the treatment and prevention of disease: Vaccines, Therapeutic Sera, Antitoxins, etc.

Detailed description and discussion of the above especially for the layman.

Lantern slides illustrating the organisms, steps in the manufacture of the preparations, and other interesting data.

Sixth Lecture. Wednesday Evening, January 3, 1923.

THE ALUMINUM AGE.

By Prof. Ralph R. Foran, P. D.

Assistant Professor of Technical and Analytical Chemistry, Philadelphia College of Pharmacy and Science.

The story of a metal so rare fifty years ago that it was used to make jewelry. Then it cost $9.00 a pound. Now it costs less than fifty cents a pound and is used in the manufacture of thousands of things, from spoons to automobiles.

It is one and a half times more plentiful than iron and is rapidly supplanting copper for many purposes. The possibilities for its use are unlimited, leading us to believe that we are coming into an "aluminum age."

Seventh Lecture. Wednesday Evening, January 17, 1923.

THE MAKING OF MEDICINES.

.(From the time of the Pharaohs down to the Scientific Age of Today).

By Prof. E. Fullerton Cook, Ph. M.

Professor of Operative Pharmacy and Director of the Pharmaceutical Laboratory, Philadelphia College of Pharmacy and Science.

The story of man's continuous effort through the ages, to relieve suffering and cure disease by means of medicines.

A brief review of the past and an account of the new medicines developed by the research of the Medical, Pharmaceutical, Chemical and Biological laboratories of today.

Eighth Lecture. Wednesday Evening, January 24, 1923.

THE COST OF PATENT MEDICINE.

By Prof. Horatio C. Wood, M. D.

Professor of Materia Medica, Philadelphia College of Pharmacy and Science.

The American people spend $150,000,000 a year on patent medicine. Does part of this money come out of your pocket? If so, you ought to know what you are getting for it. What are the chances of buying improved health? What does it cost to manufacture patent medicines? Are the statements of the venders of these medicines to be believed? Why do people write testimonials as to their cures?

Ninth Lecture. Wednesday Evening, February 14, 1923.

THE NEW ALLOYS OF IRON AND THEIR USES.

By Prof. Frank X. Moerk, Ph. M.

Director of the Technical Chemistry Courses, Philadelphia College of Pharmacy and Science.

Iron, one of the seven elements known to the Ancients, is, and has been for years, commercially the most important metal. The comparative softness, the tendency to oxidize (rusting) and the tendency to crystallize have led to the production of a number of alloys

in which these objectionable properties have been remedied by the addition usually of very small quantities of other metals. The story of "stainless steel."

Tenth Lecture. Wednesday Evening, February 28, 1923.

ANOTHER DROP OF BLOOD.

By Ivor Griffith, P. D., Ph. M.

Clinical Chemist and Serologist, Stetson Hospital, Philadelphia; Instructor in Pharmacy, Philadelphia College of Pharmacy and Science.

A continuation of a former lecture upon the subject. The newer conceptions of its functions, with particular regard to the part which it plays in conveying and utilizing products of the ductless gland laboratories. How these secretions poured into the blood stream are said to affect personality so profoundly that the genius and dullard, weakling and giant, cavalier and puritan, are so only because of inequalities in gland activities.

Eleventh Lecture. Wednesday Evening, March 14, 1923.

THE ROMANCE OF SPICES.

By Prof. Chas. H. LaWall, Pharm. D., Sc. D.

Chemist to Food Bureau, Pennsylvania Department of Agriculture; Professor of Pharmacy, Philadelphia College of Pharmacy and Science.

Many of the spices in common use today are the same as those employed by the Egyptians of the time of Menes and Cheops. In addition to their condimental and culinary uses, spices have occupied an important place in religious observances.

They were formerly valued more highly then gold or precious stones, and the search for their sources and the struggle for the control of these sources when found, has had a profound influence upon the world history. Constantinople, Venice, New Granada, and New Amsterdam, succeeded Rome as central points of trade control, largely because of the rivalry in the spice trade. America was discovered accidentally in the search for a new rout to the spice-laden Orient.

The lecture will briefly review this fascinating period of world history. It will be illustrated with specimens, growing plants, lantern slides and experiments.

Twelfth Lecture. Wednesday Evening, April 4, 1923.

CATALYSIS AND CATALYSTS.

By Prof. Samuel P. Sadtler, Ph. D., LL. D.

Professor Emeritus of Chemistry, Philadelphia College of Pharmacy and Science.

Earlier views and present views of the nature and meaning of Catalytic reactions.

Types of Catalytic reactions and practical applications of the same. Oxidation, hydrogenation, hydrolosis.

Reactions of Organic Compounds. Part played by ferments and enzymes.

Broad view of Catalysts, and their nature and function.

Illustrations in Industrial Chemistry.

Thirteenth Lecture. Wednesday Evening, April 25, 1923.

ANIMAL EATING PLANTS.

By Prof. Heber W. Youngken, Ph. D.

Professor of Biology and Pharmacognosy, Philadelphia College of Pharmacy and Science.

An exposition of the life habits and distribution of a number of flesh-eating plants, together with the peculiar adaptation of their varied structures for the allurement, capture, digestion and assimilation of their prey. This lecture will be illustrated with charts and living examples of types considered.

Fourteenth Lecture. Wednesday Evening, May 2, 1923.

EXPLOSIVES AND EXPLOSIONS.

By Prof. Henry Leffmann, A. M., M. D.

Lecturer on Research, Philadelphia College of Pharmacy and Science; Hon. Professor Organic Chemistry, Wagner Free Institute of Science, Etc.

The lecture will give a brief account of the methods of ancient warfare, and then take up the nature and actions of the modern low and high explosives used in peace and war. Explosions due to dust and gases will be considered. The lecture will be illustrated by lantern slides and experiments.

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EDITORIAL

HOW DO WE KNOW WHAT WE KNOW?

From the moment that our tiny fingers grasp instinctively at the nearest object with a grip the intensity of which is a vestigial remnant of our arboreal ancestry, we are, consciously or unconsciously, engaged in the acquisition of knowledge.

Some of us accumulate more and some of us less, depending in part upon our contacts and exposures to sources of supply, and to a great extent upon our interest in a subject.

Lack of interest is the principal reason why a greater number of persons are not possessed of a liberal education; for, once given the urge, no handicap can prevent a man from learning all that he can possibly learn about everything in which he is interested, for diversity of interests and breadth of vision are the distinguishing features of a liberally educated man, one conforming to the classic description left by Thomas Huxley.

Every one may be said to be possessed of two kinds of knowledge: that which is obtained at first hand, which might be termed primary knowledge, and that which is acquired from others by hearsay, which may be called secondary knowledge. The proportion of the amount of primary knowledge to the amount of secondary knowledge which any individual may possess is in direct ratio to his interest in fundamental facts and the breadth of his training, but even in the most highly educated individual the amount of secondary knowledge is in great excess of the amount of primary.

Take for example the names of things which are about us and which we see or use every day. How many of us know except by hearsay, whether these are the correct names?

We call a certain tree an oak and another a maple. Is this because we have been told by others that these are the correct names for these respective trees, or have we actually established their identity by a botanical investigation? Very likely the former, and when we come to take a stock account of our knowledge we realize how little we are actually certain about and how much is vague or unidentifiable as to its source.

In education, therefore, the laboratory method of instruction is the only method of imparting primary knowledge, for the lecturer is only a disseminator of secondary knowledge which may have and probably has come to him in the same manner.

There are some departments of learning in which the secondary knowledge necessarily predominates, as in history. There are others in which the knowledge is almost altogether primary as in laboratory physics and mathematics. The sciences stand about midway in the list, for in them both methods of instruction are possible, and it is a sign of progress that laboratory courses are coming to be more and more recognized as absolutely essential in establishing the fundamental principles, without which an individual might as well have no education at all for he has no standards for comparison and is therefore unable to distinguish the true from the false.

Along with the primary and secondary knowledge, which we will assume is correct, whatever may have been its method of acquirement is a lot of misinformation which passes current for knowledge with many who are unable to distinguish between truth and error. It is due to this contamination that so many individuals fall victims to charlatans, for credulity rises in proportion to the lack of sound fundamental knowledge. The age through which we are passing has been aptly termed an age of credulity.

Can we prevent the next generation from falling victims to the same evil? We can if we continue to develop along the sound lines of progress in education that have recently been established. More and better laboratory courses; lectures by men who have acquired their knowldege at first hand and who use abundant illustrative material; and above all, a standard of accomplishment and progress on the part of the student that will insure his being acquainted with the simple facts before he takes up those which are more complex. Not more, but better students should be the watchword of every educational institution.

More primary and less secondary knowledge should be the aim of every teacher. When we can raise the ratio of primary to secondary knowledge and diminish the proportion of misinformation a great result will have been achieved and more of us will be able to understand why and how we know what we know.

C. H. L.

ORIGINAL ARTICLES

CHEMISTRY AS AN AID IN THE DETECTION OF CRIME.*

By Henry Leffmann, A. M., M. D.

Lecturer on Research, Philadelphia College of Pharmacy and Science; Emeritus Pathological Chemist, Jefferson Medical College Hospital.

In treating this subject, the scope of chemistry must be extended to include several accessory methods, especially some that might be in strict classification assigned to physics. Physicists, however, are but rarely called into consultation in legal actions, except in connection with those concerning patents. Chemists, of course, are also frequently called on to testify in patent litigation, but the present study relates wholly to the service of chemistry and its allied methods to the detection of crimes and misdemeanors. In civilized countries, at the present day, the commission of crime is an offense against the state, rather than against the person. The theory is that the state guarantees to each citizen equal protection of the law, and, therefore, must enforce, against any one who infringes such guarantees, the punishments provided.

Chemistry came early in recognition as an important, in fact, indispensable, aid to the detection of many forms of crime, but especially in the detection of poisons. Toxicology has for a long while been the special field of the chemist. The word, by the way, comes from a Greek work meaning a "bow," the weapon used by primitive man. The connection between a bow and poison lies presumably in the use of poisons on the point of the arrow, and thus "pharmakon toxicon," "arrow poison," came to be applicable to all forms of

*First Lecture in the 1922-1923 Course of Public Lectures at the Philadelphia College of Pharmacy and Science. Delivered October 11, 1922.

poisons. As chemistry was for many centuries pursued in a somewhat haphazard manner, a systematic treatment of it or of its practical applications was not possible. Notwithstanding the long use of poisons for criminal purposes, the founder of the modern science of toxicology may be considered to be Mathieu J. B. Orfila, a Spaniard by birth, who was born in 1787, the year in which the Convention assembled to frame a Constitution for the United States. His book, "A Treatise on Poisons or General Toxicology," published in French before he was thirty years of age, laid the foundation of a systematic development of the subject.

The great advances made in methods of reseach and in the precision and accuracy of chemical and physical procedures, have given to toxicology a much greater scope and greater exactness, and it will be the purpose of this lecture to indicate some of the features of the present procedures. While the detection of poisons is still one of the main features of the chemist engaged in aiding the police and the courts, other questions of importance have arisen, among which is the detection of blood and the determination of the animal from which derived. The modern control of foods and beverages has multiplied greatly the applications of chemistry, and compelled much research and investigation. Crime of all kinds, from murder to petty theft, manifests a good deal of ingenuity and resource, and it is not left to the chemist to perfect a process and then rest quietly in the employment of it. Offenders of all grades can also employ scientists, and hence the work of the public chemist is a sort of a game of hide and seek. A process for detection of a certain poison or adulterant becomes known; those who have criminal intent can frequently find either a substitute which is satisfactory for their purposes, but does not respond to the tests for the original substance, or they can mask the original substance so that the standard test fails. The chemist may be said to be "still achieving, still pursuing," and he is constantly discarding processes either because better ones are available or because the ingenuity of law-breakers has changed conditions.

The scope of this lecture does not allow of more than a glimpse at the many applications of chemistry in the service of the law, and hence a few instances of striking character will be presented, and even these can only be given brief description.

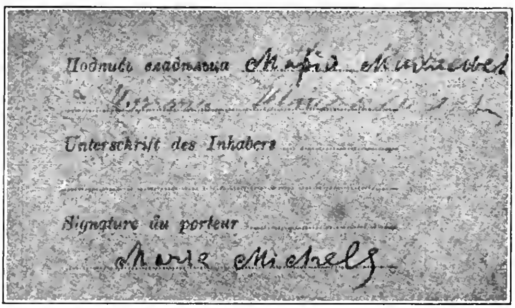
At the present day, the chemist cannot dispense with the use

of the microscope, which though a physical instrument has taken so prominent a place in the chemical laboratory as to have become a part of that equipment. The microscope has long been used in the detection and distinction of blood-stains. For many years a great reliance was placed on the form of the blood corpuscles, which are materially different in the different classes of animals, but for the higher animals, that is, the common domestic and wild mammals, the form (shape) is about the same although some difference in size is noted. The blood of birds, reptiles and fish shows elliptical corpuscles, while those of mammals are round, but since, in cases of blood-stains, it is possible that some common four-footed animal may have been the source of the blood, a specific distinction of human blood is greatly to be desired. For a long while this was impossible, but a test, known as Bordet's test, is now applicable. This usually is carried out as follows: A small amount of human blood deprived of fibrin (the clotting material) is injected into the blood of a rabbit, at intervals of four days, until two fluid ounces have been introduced. After about ten days, the animal is bled, the blood serum introduced into sterile tubes and kept for use. In applying this test some of the solution of the stain is mixed with a minute amount of the prepared serum and the mixture kept at 37° C. If human blood is present, a turbidity will be produced which in a few hours will become a flocculent precipitate. The test liquid prepared as indicated gives no reaction with any of the animals common in temperate climate, but it does react with the blood of some of the manlike apes.

A general test for blood is with tincture of guaiac resin and hydrogen peroxide which gives a blue tint. Hawk has found that if the sample to be tested is boiled for 15 to 20 seconds all materials that stimulate blood are so altered that they no longer give the color, but blood preserves its property. Many years ago a man on trial for murder attempted to account for some blood stains on his clothing by saying that he had been carrying some recently killed chickens, but the corpuscles of the stains showed clearly that they had come from no such source as alleged.

One of the most satisfactory methods of identifying substances is by means of their crystalline form. When the crystals are large, as they commonly are in natural minerals and in substances manufactured in large quantity, inspection with the unassisted eye suf-

fices, but in many cases, crystals are very minute and microscopic examination is needed. At the present time, the appliances for such examinations have been brought to a very high pitch, among other methods being modifications of light. Several such modifications are now familiar. The simplest is making a change in the direction of the light as it falls on the object. In this way differences in the surface are made more evident. Another method is by means of colored screens. Polarized light has been of much value. Recently, much valuable information has been obtained by the use of rays of light that are invisible to the human eye, but which have a strong effect on a photographic plate. Some examples of these methods will now be given.



Erasures made more distinct by using color screen.

Among the substances which have long been used in criminal poisoning is arsenic. This occurs usually as a white powder, somewhat gritty, and but slightly soluble in water and common liquids. Under the microscope it is seen to consist of brilliant crystals showing more or less triangular faces. The size of these crystals differs somewhat according to the method of manufacture. Owing to the slight solubility of arsenic in the fluids of the body, portions of it may remain for hours in the stomach without losing their distinct crystalline form.

In a case tried in Philadelphia many years ago, several grains of arsenic were found in the stomach of a woman, who had died under suspicious conditions. Her husband was tried for poisoning her, and the defense alleged that she had been taking a trituration of arsenic as a complexion improver. Homœopathic triturations of

arsenic were found in the house, but the arsenic in the stomach was in distinct crystals, and it was thus shown that other arsenic had been used. The prisoner was convicted and hanged, and subsequently the attorneys for the defense admitted the truth of the expert's contention.

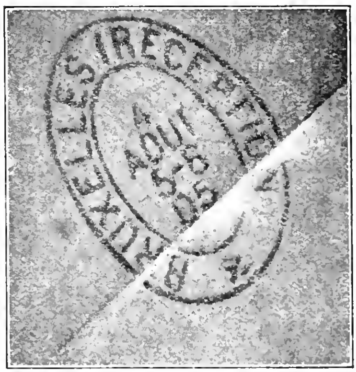
In the Mary Stannard case, tried in Connecticut, the defense alleged that the arsenic found in the stomach was part of that contained in a package that had been bought for killing vermin infesting a barn, but it was shown that the proportion of crystals of a certain kind was very different in the sample from that in the stomach. The testimony, however, in this case did not convince the jury.

The manufacture of chemicals on the large scale may not be carried out in the same way in different establishments, and hence, it is sometimes possible to determine the specific source of a substance. In this manner, it was found a number of years ago that two large establishments in Philadelphia produced distinctly different forms of bismuth subnitrate. There was no evidence that one product was inferior, but merely that some difference in the procedure of manufacture caused the formation of somewhat different crystals.

Adulteration of food and drugs is a very extensive and frequent form of crime. The discovery of such adulterations is now the regular business of hundreds of chemists, and much literature is annually published relating to the subject. In this sketch only a few items can be presented. Naturally, the substitution of cheap materials for dear ones is a common form. In this way cheaper starches, such as corn starch, are substituted for arrow root starch; alum is substituted for cream of tartar in baking powders; vegetable and animal fats are substituted for butter; glucose is substituted for cane sugar. The detection of these and similar adulterations requires an elaborate equipment and a thorough training, and the difficulties of the chemist are seriously increased by the fact that new methods of adulteration are continually being introduced, and old methods abandoned. Sometimes an incidental ingredient that happens to be in the adulterating material and not in the genuine substance may serve as means of detection. As an instance of this may be mentioned the use of agar as gelatinizing material in ice cream. Agar is the tissue of a sea plant found in the Pacific ocean. It forms a jelly with water that does not melt at ordinary summer temperature. It happens to be usually accompanied by numerous diatoms, which

are minute siliceous skeletons, of characteristic form. As the agar and the food material with which it may be associated can be easily destroyed by strong acids, while the skeletons of the diatoms resist such action, it has been at times possible to detect the addition of sugar by detecting the diatoms.

Crimes of various types are connected with forgery and the alteration of documents. Checks are raised, wills and deeds forged and other misuses made of the arts of writing and printing. A good deal of investigation has been bestowed on the methods of detecting such crimes. Several phases may be presented. Attempts are not infrequently made to manipulate documents so as to indicate a much



Postmark on envelope which had been opened and reclosed. Left-hand picture under direct light; right-hand picture under oblique light, showing advantage of the latter method.

earlier date of execution than is the fact. Many years ago one of the political parties in Philadelphia, attempted to secure the naturalization of a large number of aliens by means of forged papers alleged to have been taken out several years previously. To give the appearance of age, the papers were soaked in coffee. This method has been occasionally used. A simple test is the application of a solution of a ferric salt, which, if coffee infusion is present, will produce a black stain. In former times a good deal of stress was laid on the water-marks. These were often somewhat fantastic designs, but in other cases simple designs with dates. The earliest water-mark is very simple and is said to date from about 1300. Of recent years

the introduction of wood pulp and ground wood has given rise to very inferior products, especially for newspapers and cheap books. Sometimes news paper contains very little true pulp and hence early becomes yellow and very brittle.

The detection of such inferior materials is often very important, and chemical and microscopical methods are employed. The several fibres used in paper-making have distinct characteristics and, in addition, ground wood gives distinct colors with certain solutions. The detection of ground wood might serve to show a fraudulent document, since if a deed or other legal document purported to have been drawn at a date previous to the use of such wood was found to contain such material, the fraud would be evident.

The alteration of checks is one of the most serious troubles that business men have. In spite of much ingenuity that has been applied in preventing these frauds, cases are constantly occurring, although it is claimed that lately efficient methods have been devised. In former days merchants were content to write their checks on plain white paper, but roguery is now too common, and checks are printed on safety papers. Photography has been successfully applied to the detection of alterations and forgeries. By the use of color screens and special forms of light, the texture of the paper and the detail of the writing and erasures can be brought out often quite vividly.

The substitution of artificial colors for natural colors, especially in the preparation of fruit juices, syrups, jams, jellies and soft drinks is a very frequent form of adulteration. The methods of detection in these cases are purely chemical, principally by the use of dyeing of woolen or silk fabrics. Natural colors, at least, of the common fruits and flowers, do not dye very firmly, while artificial colors do. For the detection of coloring in milk, butter and other milk products special tests are employed.

The investigation of crime involves several distinct features. The psychologic phases of human action must be taken into consideration, and, in many cases, scientific investigations are not applicable, but on the other hand chemistry and its closely allied sciences are of great use in indicating the exact conditions under which crime has been committed.

It must, however, be borne in mind that the work of the chemist is not always in the direction of positive results, or of securing conviction for crime. In many cases the laboratory fails to solve the

problem submitted, and in others finds results contradictory to those that have been assumed. The world hears less of such cases than of the affirmative ones, but failures are often very instructive. Very often, popular clamor and mistaken inferences lead to investigations which ultimately show that the charges are without foundation, but sometimes the contradiction does not get the currency that the original assertion did. During the late war, statements were made that powdered glass was found in certain food articles supplied to the camps. Naturally, much indignation was aroused, for such admixture could only be the work of a deadly enemy to the nation.

Finger marks of accused person taken respectively from a bottle and from a menu card, showing identity.

The matter was dropped, but the general public has not heard the outcome of the scientific investigation. In at least one case it was found that the material supposed to be powdered glass was really crystals of ammonium magnesium phosphate, formed through some chemical change that had occurred in the materials. In another case a sample of grape jelly was submitted to Dr. LaWall, on account of brilliant particles scattered through it, the person who brought the sample being convinced that these were powdered glass. Analysis showed them to be crystals of cream of tartar, a constant ingredient of grape-juice, which had crystallized out. The client, however, was not satisfied with the analyst's statement until a few of the crystals were dissolved in boiling water.

Chemists who do work for physicians meet with many instances of false claims. Red stains are alleged to be blood; fragments of common stones are submitted as calculi and lots of other fakes are practiced. Those who are engaged in industrial work, such as the analysis of ores and minerals, are constantly meeting with faked minerals, which have been submitted to boost some mining or manufacturing scheme. "Fool's gold" is an old name for an iron-containing mineral which has a bright gold lustre and has deceived many a searcher for mining investments.

[The illustrations are taken from Wolf-Czapek's *"Angewandte Photographie."*]

JOHNNY APPLESEED.*

By J. W. Sturmer, Ph. M.

It is hard to realize—as one passes through Ohio or Indiana, on the way to Cleveland—that this region, a little more than a century ago, was a vast forest, the cherished hunting grounds of the red men. Here for unnumbered generations they kindled their camp fires, erected their wigwams and lived their lives in peace and in tribal warfare, in accordance with their traditions. Whence they came, or when they came, no one knows; history records only the dramatic and tragic episodes of their passing.

The pale face from the distant lands of the rising sun, who came to dispute the red man's exclusive right to his ancestral hunting grounds, was no welcome intruder. But it was with an intense hatred that the Indian contemplated the arrival of the pioneer who came to build a permanent home. For with his axe he felled the trees and made great clearings in the sombre forest. His plow uprooted the familiar flora and prepared the ground for strange grain. His gun exterminated the game. In due course he built roads, linking the clearings. He bridged the streams, drained the swamps, founded villages teeming with strange activities, and indeed changed the very face of nature as effectively as some great physical cataclysm, coming as an act of wrath of the Great Spirit.

* Presented to Cleveland Meeting A. Ph. A. Permission granted for publication prior to appearance in *A. Ph. A. Journal.*

But the influx of these dauntless and marvelously efficient pale-faces, once begun, never slackened. They brought their kith and kin. Their block houses and trading posts soon occupied the strategic positions along the water courses and the Indian saw himself dispossessed of his hunting grounds. He was forced to retreat deeper and yet deeper into the forest, which he did, however, with the determination to exact of the intruders the highest possible price in human blood. Hence it is that the early history of Ohio and Indiana is a record of ambuscades, and massacre, and of the heroic defense of their newly established homes by the early settlers.

Both history and fiction have faithfully portrayed the typical pioneer, as handy with the gun as with his tools of agriculture, a sturdy figure, the advance guard in the great military invasion which conquered the Middle West for the white man.

Yet, when about a hundred years ago, the Indians had planned a night attack upon a settlement a little more than sixty-five miles southwest of where we now sit (Cleveland), the warning was brought by a strange white man who had traversed unarmed the great forest, which beyond gun-shot range of the clearings was a "no man's land," full of lurking dangers; and it was he, who, traveling at night, brought reinforcements from a blockhouse thirty miles distant. A tall, gaunt man, clad in clothing much the worse for wear, the coat having been improvised from a coffee sack, and the mush pot of his meagre camping outfit doing service as a helmet, he must have been an odd figure, even in those unconventional days. But he was a welcome guest at every pioneer's fireside, for he was none other than Johnny Appleseed—Swedenborgian missionary, philosopher, poet, nature lover—a kind of nomadic Thoreau, but with a deep human sympathy, gentle and kindly, whose philanthropy extended to the stranger, and whose altruism contemplated the generations who were to inhabit this newly settled region. He was the pioneer nursery man of the Middle West and the distributor of seeds of medicinal plants brought from the older settlements. As he put it—

"I love to plant a little seed
Whose fruit I'll never see;
Some hungry stranger it may feed,
When it's become a tree."

His real name was John Chapman, and his birthplace, Springfield, Massachusetts. In 1806 he arrived in Ohio, and planted his

first Ohio nursery near the present town of Steubenville. From this point he moved westward and northward, until his plantings formed a chain extending into Northern Indiana. His seedlings and his seeds of herbs were distributed without charge, though he would accept a night's lodging, a meal, or some simple article for his camping outfit. For forty-six years he was a rover along his chain of nurseries, and at the ripe age of seventy-six he died of pneumonia, at a farmer's home, a few miles north of Fort Wayne, Indiana. Nearby, in what is known as Archer's Cemetery, rest his remains. And in Sweeney Park, in the aforementioned city, the Indiana Horticultural Society has erected a memorial to his memory—a granite boulder, worn smooth by its glacial journey from some distant parent rock. Old apple trees grown from the stock provided by Johnny Appleseed, are still bearing fruit, and several may be found in Fort Wayne, near the conflux of the St. Mary and St. Joseph rivers, which form the Maumee. But no one can estimate how many gardens in Ohio and Indiana contain medicinal plants traceable to the seeds which he distributed; and the indigenous flora has to a large degree been replaced in certain sections by his plants of Eastern origin which have since escaped cultivation.

He was no great botanist, and his knowledge of the medicinal worth of plants was rather erratic. Some of the unwelcome weeds, as, for example, the ill-smelling dog fennel, *Anthemis cotula,* now so common in many rural school yards, and on farmland allowed to lie fallow, were disseminated by Johnny Appleseed, with the mistaken idea that he was providing valuable medicine for his fellow man. But as to that, he is far from standing alone when it comes to being in error about the true therapeutic value of plants purported to be medicinal.

John Chapman—Johnny Appleseed—one of the most picturesque figures of the pioneer days of this section, lived a life of peace in an era of Indian wars. When his contemporaries established homes, and accumulated property, he, though a poor man, spent his allotted years in practical philanthropic enterprise. He lead no military expeditions, framed no laws, laid out no towns. Yet who would say that this gentle, eccentric distributor of seeds, and of young apple trees, by his example of outstanding unselfishness, did not leave a profound impress upon the pioneers of this section, just as his curative herbs have spread to replace in part the native flora. Preceding the

country doctor, and the village apothecary, he was literally the pioneer in supplying medicine to the settlers of this region. The history of Ohio and Indiana pharmacy would therefore be incomplete if it did not include some reference to this uncouth but kindly wanderer in the wilderness—Johnny Appleseed.

DETECTION OF DIETHYLPHTHALATE AND PHTHALEINS.*

By Ralph L. Calvert, Ph. G.

Within the past year a tax-free alcohol for use in perfumery has been available. This alcohol is denatured with diethylphthalate, and acccording to Formula 39 B; should contain 2½ gallons of diethylphthalate to every 100 gallons of ethyl alcohol. This denaturant is a colorless, practically odorless liquid, oily in appearance and has a specific gravity of 1.175 at 25° C.; boiling point between 290-297° C. It is readily miscible with alcohol, ether, petroleum ether, and many other similar solvents. It has a very pronounced bitter and disagreeable taste, producing a sense of numbness to the tongue.

In spite of its disagreeable taste, it is a source of temptation to the boot-legger brotherhood, and quite frequently one finds it, quite cleverly disguised in so-called whiskey. It can easily be detected as stated by Dr. A. B. Lyons in an article in the April number of the *Journal of the American Pharmaceutical Association,* by shaking out the diethylphthalate from the sample with light petroleum ether, evaporating to dryness, adding sodium or potassium hydroxide, evaporating and adding a few drops of concentrated sulphuric acid and fusing with resorcin to an orange yellow color. By dissolving this fused mass in water and adding an excess of ammonia water a yellow-green fluorescence appears.

This test, however, is not satisfactory, especially if diethylphthalate is present in a minute amount. A blank test made by fusing resorcin with sodium or potassium hydroxide, taking up with water and adding an excess of ammonia water shows the same fluorescence.

A test which has been found very satisfactory can easily be performed. To 3 or 5 cc. of the sample in a test tube add 5 to 10

* Read before the 1922 Meeting of the Penna. Pharm. Assoc.

drops of phenol, 10 drops of concentrated sulphuric acid and heat slowly over a small bunsen flame until most of the alcohol has been driven off and the liquid assumes a red color. Now cool the test tube and cautiously add 15-25 cc. of water, when the red color will disappear and the liquid become turbid (if positive). Now add an excess of sodium or potassium hydroxide. A red color denotes the presence of diethylphthalate or a phthalein in the sample. Ammonium hydroxide is not recommended owing to the possible formation of phenol-di-iminophthalein, a substance giving a colorless solution with alkalies.

If the sample be alcohol or a colorless solution the test may be applied directly, but in testing whiskey better results are obtained by rapid distillation and the subsequent evaporation of the distillate to a small volume on a water bath. Good results may be obtained by shaking out with light petroleum ether a few times and then evaporating off the petroleum ether at a comparatively low temperature.

The test as described is rather delicate, considering that 1 cc. of a 1-1000 solution gave unmistakable results. The end reaction depends upon the formation of phenolphthalein by the action of hot sulphuric acid on phenol and diethylphthalate.

Department of Theory and Practice of Pharmacy,
Philadelphia College of Pharmacy and Science.

PRINCIPLES OF PHARMACEUTICAL ETHICS.*

Chapter I.—The Duties of the Pharmacist in Connection With His Services to the Public.

Pharmacy has for its primary object the service which it can render to the public in safeguarding the handling, sale, compounding and dispensing of medicinal substances.

The practice of pharmacy demands knowledge, skill and integrity on the part of those engaged in it. Pharmacists are required to pass certain educational tests in order to qualify under the laws

* Presented by Dean Charles Herbert LaWall of the Philadelphia College of Pharmacy and Science before the Section on Education and Legislation of the American Pharmaceutical Association (Annual Convention, Cleveland, 1922). Revised, approved and referred by that Section to the General Session for approval and adoption. Adopted by the General Session and widespread publicity urged.

of our States. The States thus restrict the practice of pharmacy to those persons who by reason of special training and qualifications are able to qualify under regulatory requirements and grant to them privileges necessarily denied to others.

In return the States expect the Pharmacist to recognize his responsibility to the community and to fulfil his professional obligations honorably and with due regard for the physical and moral well-being of society.

The pharmacist should uphold the approved legal standards of the United States Pharmacopœia and the National Formulary for articles which are official in either of these works, and should, as far as possible, encourage the use of these official drugs and preparations and discourage the use of nostrums. He should sell and dispense only drugs of the best quality for medicinal use and for filling prescriptions.

He should neither buy, sell nor use substandard drugs for uses which are in any way connected with medicinal purposes.

The pharmacist should be properly remunerated by the public for his knowledge and skill when used in its behalf in compounding prescriptions, and his fee for such professional work should take into account the time consumed and the great responsibility involved as well as the cost of the ingredients.

The pharmacist should not sell or dispense powerful drugs and poisons indiscriminately to persons not properly qualified to administer or use them, and should use every proper precaution to safeguard the public from poisons and from all habit-forming medicines.

The pharmacist, being legally entrusted with the dispensing and sale of narcotic drugs and alcoholic liquors, should merit this responsibility by upholding and conforming to the laws and regulations governing the distribution of these substances.

The pharmacist should seek to enlist and merit the confidence of his patrons and when this confidence is won it should be jealously guarded and never abused by extortion or misrepresentation or in any other manner.

The pharmacist should consider the knowledge which he gains of their ailments, and the confidences of his patrons regarding these matters, as entrusted to his honor, and he should never divulge such facts unless compelled to do so by law.

The pharmacist should hold the health and safety of his patrons to be of first consideration; he should make no attempt to prescribe or

treat diseases or strive to sell drugs or remedies of any kind simply for the sake of profit.

He should keep his store clean, neat and sanitary in all its departments and should be well supplied with accurate measuring and weighing devices and other suitable apparatus for the proper performance of his professional duties.

It is considered inimical to public welfare for the pharmacist to have any clandestine arrangement with any physician in which fees are divided or in which secret prescriptions are concerned.

The pharmacist should primarily be a good citizen, and should uphold and defend the laws of the State and nation. He should inform himself concerning the laws, particularly those relating to food and drug adulteration and those pertaining to health and sanitation and should always be ready to co-operate with the proper authorities having charge of the enforcement of the laws.

The pharmacist should be willing to join any constructive effort to promote the public welfare and he should regulate his public and private conduct and deeds so as to entitle him to the respect and confidence of the community in which he practices.

Chapter II.—The Duties of the Pharmacist in His Relations to the Physician.

The pharmacist even when urgently requested so to do should always refuse to prescribe or attempt diagnoses. He should, under such circumstances, refer applicants for medical aid to a reputable legally qualified physician. In cases of extreme emergency as in accident or sudden illness on the street in which persons are brought to him pending the arrival of a physician such prompt action should be taken to prevent suffering as is dictated by humanitarian impulses and guided by scientific knowledge and common sense.

The pharmacist should not, under any circumstances, substitute one article for another, or one make of an article for another in a prescription, without the consent of the physician who wrote it. No change should be made in a physician's prescription except such as is essentially warranted by correct pharmaceutical procedure, nor any that will interfere with the obvious intent of the prescriber, as regards therapeutic action.

He should follow the physician's directions explicitly in the matter of refilling prescriptions, copying the formula upon the label or

giving a copy of the prescription to the patient. He should not add any extra directions or caution or poison labels without due regard for the wishes of the prescriber, providing the safety of the patient is not jeopardized.

Whenever there is doubt as to the interpretation of the physician's prescription or directions, he should invariably confer with the physician in order to avoid a possible mistake or an unpleasant situation.

He should never discuss the therapeutic effect of a physician's prescription with a patron nor disclose details of composition which the physician has withheld, suggesting to the patient that such details can be properly discussed with the prescriber only.

Where an obvious error or omission in a prescription is detected by the pharmacist, he should protect the interests of his patron and also the reputation of the physician by conferring confidentially upon the subject, using the utmost caution and delicacy in handling such an important matter.

Chapter III.—The Duties of Pharmacists to Each Other and to the Profession at Large.

The pharmacist should strive to perfect and enlarge his professional knowledge. He should contribute his share toward the scientific progress of his profession and encourage and participate in research, investigation and study.

He should associate himself with pharmaceutical organizations whose aims are compatible with this code of ethics and to whose membership he may be eligible. He should contribute his share of time and energy and expense to carrying on the work of these organizations and promoting their welfare. He should keep himself informed upon professional matters by reading current pharmaceutical and medical literature.

He should perform no act, nor should he be a party to any transaction which will bring discredit to himself or to his profession or in any way bring criticism upon it, nor should he unwarrantedly criticize a fellow pharmacist or do anything to diminish the trust reposed in the practitioners of pharmacy.

The pharmacist should expose any corrupt or dishonest conduct of any member of his profession which comes to his certain knowledge, through those accredited processes provided by the civil laws or

the rules and regulations of pharmaceutical organizations, and he should aid in driving the unworthy out of the calling.

He should not accept agencies for nostrums nor allow his name to be used in connection with advertisements or correspondence for furthering their sale.

He should courteously aid a fellow pharmacist who may request advice or professional information or who in an emergency, needs supplies.

He should not aid any person to evade legal requirements regarding character, time or practical experience by carelessly or improperly endorsing or improving statements relating thereto.

He should not imitate the labels of his competitors nor take any other unfair advantage of merited professional or commercial success. When a bottle or package of a medicine is brought to him to be refilled, he should remove all other labels and place his own thereon unless the patron requests otherwise.

He should not fill orders which come to him by mistake, being originally intended for a competitor.

He should deal fairly with manufacturers and wholesale druggists from whom he purchases his supplies; all goods received in error or excess and all undercharges should be as promptly reported as are shortages and overcharges.

He should earnestly strive to follow all proper trade regulations and rules, promptly meet all obligations and closey adhere to all contracts and agreements.

ABSTRACTED AND REPRINTED ARTICLES

THE HUMAN SIDE OF CHEMISTRY.*

By Edwin E. Slosson.

A hundred years ago chemistry was a toy. Today it is a tool. From the diversion of the philosopher it has developed into a practical profession of the highest importance to humanity. All the sciences may be expected likewise to earn their own living when they get old enough. But chemistry has in an astonishingly short time

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reached maturity and become more than self-supporting. We have recently seen factories hatching from test tubes, like fowl from eggs. Some of our friends in sciences that are older but do not yet pay dividends look upon chemistry with a certain suspicion and perhaps envy because of its success in a business way. They want to keep science as a sport and seem anxious lest the chemist lose his amateur status by making money. They need not worry, for whatever rewards come to the chemist—or to his employer—will be an infinitesimal fraction of what chemistry has given to the world.

The Chemist Too Modest.

The chemist is the most modest of men. He does not claim credit for what others do. He does not claim credit for all he does. Indeed, he often disclaims credit for some of his highest achievements. If he makes butter, he is willing that the credit should go to the cow, while he takes the cash; if he spins the silk for a dress he pretends that he is a mere worm; if he constructs a pearl he disguises himself as an oyster. He will even condescend to take the place of the humble tortoise and secrete a shell.

Modesty is an admirable thing, but it has its dangers if overdone. When you assume a deprecatory attitude toward your achievements, there is always the danger that other folks may believe you. They may take up at your own price mark. It is safe to profess unworthiness only when you are sure that those present will contradict you.

The result of this persistent attempt of the chemist to minimize his own importance is that the outside world fails to appreciate the value of his contributions to modern civilization and does not at all realize what the chemist might do in the future if he had a free hand. Don't camouflage your creations by calling them imitations. If you invent a synthetic plastic, some condensation product of phenol with an aldehyde or an amine, don't call it a mineral or vegetable. Name it after yourself.

A synthetic product should have a synthetic name. One of the fortunate effects of the unfortunate failure of our patent laws to afford proper protection is that it has led to the coining of new names for new things; too often to the coining of new names for old things, it is true, but still a good movement, for it brings people to the recognition of the fact that there are new things under the sun and

that most of them come from the chemist. The chemist has become the greatest coiner of words in the world. The rapid expansion of organic chemistry demanded the fabrication of some 250,000 new names, with provision for an indefinite increase in the future. Nobody ever had such a job since Adam was called upon to give names to all the animals as they filed before him. It meant doubling the dictionary. In accomplishing the gigantic task of constructive philology, the chemist has got some unwieldy combinations, but on the other hand he has, under the pressure of commercialism, contrived some very neat and handy nicknames for everyday use. The coinage of "Kodak" confounds the philologists. But they have determined the derivation of "balopticon" to their own satisfaction. It is derived, they say, from two Greek roots, "ballo," to throw, and "optikos," sight, a very proper term for a projection lantern, and removes the suspicion that the name of the apparatus might conceal a sly reference to its makers, the Bausch & Lomb Optical Company.

This is much better than the old custom of carrying over old names to new things. Fish glue films were called isinglass as though they were a kind of glass. When mica took its place it too was called isinglass, even in stove windows, and what is now called mica is mostly celluloid, and what is called celluloid, may be something else. Language lingers and lags behind the advance of science. That is because the public cannot realize the creative power of chemistry—that a compound is a different thing from the elements that compose it.

New Era in Chemistry.

In chemistry the whole is not equal to the sum of its parts, never qualitatively and possibly not always quantitatively. If we put together four atoms of hydrogen each weighing 1.008 we get one atom of helium that weighs only 4. The .008's have somehow got lost in the shuffle.

Chemistry is the creative science. Don't suspect me of taking advantage of my position to work in anything personal. I am quoting Berthelot, who foretold the time when all our foods would be made by the chemist. I do not see so far ahead as that, but it is certain that chemistry is entering upon a new era when its constructive powers will have wider scope and largely relieve us of our forms of life. The chemist of the future will not be content to do analytical

work such as the house wrecker does, or imitative work such as the forger does, but the chemist will do original work such as he alone can do.

The future of civilization is fixed by the scientist because he has the power to control the basic reaction on which our vital and mechanical power depends, the oxidation of carbon and hydrogen. All wealth is in its essence energy, and the material sources of energy are practically but two, food and fuel, very similar in composition and just alike in their final products. If the fuel falls short, our modern civilization will disappear and humanity will revert to a primitive condition. If our food supply falls short, life itself will be limited. The two factors of civilization, mass and potential, population and the standard of living, quantity and quality, are functions of the food and fuel supply. The Law of Malthus has often been refuted, but has never been repealed. The world has now been all surveyed and staked out in claims like a mining camp after the first rush is over. Quarrels over stakes and limits will continue and we can only hope that they will be settled in court rather than by the cruder methods of Roaring Camp. The late unpleasantness was started by a claim jumper who was too quick with his shooting iron and had to be handled by the vigilance committee. But how such quarrels are to be settled in the future is no more the concern of the chemist than of any other citizen. The peculiar business of the chemist is to see that there is something worth quarreling about. He is to show how to create and economize wealth and is not responsible for its abuse and destruction.

The period of the extension of civilization is approaching its end, and henceforth progress must take the form of intensification of civilization. People must cease to expand and begin to construct. There are no more continents to discover. No more worlds to conquer. The new era will require new methods and here the constructive powers of the chemist will come into play. The world will more and more come to depend upon him. It does not require any chemistry to pick a cocoanut off a palm tree. It only requires a rope and prehensile toes. But it does require chemistry to extract the oil from the copra and hydrogenate it and sell it as a bread spread to a hostile public. It does not require any chemistry to manure a field, but it does require chemistry to fix the free nitrogen of the air.

Chemistry is continually gaining ground from biology. Vast areas, which biologists once claimed but had neglected, have now gone over to the chemists. In fact, it seems that whenever a vital process or products had been thoroughly studied and understood, it is found to belong to physics or chemistry. Consequently, the chemist is inclined to regard biology as merely an unexplored province of chemistry. Many a loyal biologist in pursuit of some legitimate line of research well within his own territory has found in the course of time that he has unconsciously become a chemist. Pasteur many years ago crossed the boundary in the opposite direction; while hunting up assymmetric crystals he got over into abiogenesis. As an offset to our gains from biology we have lost to physics the invaluable province lying inside the atom. In the modus vivendi that prevailed when I was a student, anything bigger than the molecule belonged to the physicist, and everything smaller to the chemist. But a band of bold physicists, led by Thomson and Rutherford, made a raid into the hinterland of chemistry and captured the interior of the atom. Scientific boundaries, like national boundaries, are merely imaginary lines and may be drawn at convenience, though they are mostly drawn at inconvenience.

The new era that we are entering is a period of merger in the sciences. The traditional boundaries are being wiped out. The nice, precise, little, dogmatic definitions and distinctions that used to fill the first few pages of an elementary chemistry textbook have run together like bad dyes in warm water. The old arbitrary division lines between chemistry and physics, organic and inorganic, natural and artificial matter and energy, molecule and mass, chemical affinity and adhesive forces, are disappearing. Scientists are discovering what the artists have long known that there are no lines in nature.

Acetic acid may be made by a vinegar plant or by a hydro-electric plant. A reaction may be accelerated by a high temperature *or* a catalytic metal. It has recently been announced that rickets in children may be cured by sunlight *or* cod-liver oil. Let us hope that the children will be allowed their choice of which remedy they will take.

Every annual session of this society knocks some of our old ideas in the head. At this meeting Professor McKee will try to persuade us that there is no shale oil in oil shale, and Professor Bancroft that there is no color in the peacock's tail.

Chemistry is now passing through a revolutionary era like that of 150 years ago when Lavoisier's balance overthrew the phlogiston theory. But as Priestley stuck to phlogiston to the day of his death, although his discovery of oxygen had given it the deathblow, so some of us elders show a certain reluctance in relinquishing our old familiar images. There was something solid and satisfying about our molecular models made of wooden balls, stained with aniline dyes and stuck together with wires. But these have now been relegated to the top shelves of the storeroom and we have to get used to a newfangled atom, composed of a vacuum and algebraic symbols. Minus marks are flying round a plus mark like automobiles on a race course and whenever one skids it flashes its light. In place of a stout wirey valence bond, stiff and straight, that sticks when it is once put into its hole, we are offered two electrons playing tag in a ring, like cats chasing each other's tails.

But the new conceptions, as we all realize, are vastly in advance of the old, for they give us the ability to handle the ultimate and individual units of matter. Clerk Maxwell held that the laws of nature were merely and inevitably statistical, that we could only deal with averages of multitudes of indistinguishable molecules and movements. If that were true, chemistry would be less of an exact science than sociology, for the chemist cannot tell within many million how many molecules will pass in a minute through a tube connecting two flasks of gases of unequal density, while the social statistician can tell within a few thousand how many people will pass in a day through the Hudson tube connecting Jersey City and New York. But now that we have the power to discern and track the individual atom and even electron, Maxwell's argument no longer holds. We can sort out isotopes by their weights and divide electrons according to their velocities. We have, therefore, virtually found the sorting demon which, as Maxwell foresaw, might upset or evade the second Law of Thermodynamics and so bring order out of disorder and work out of uniform temperature.

Maxwell argues that all the atoms of an element must have the same weight, for he says ("Theory of Heat," p. 329):

"If the molecules of some substance, such as hydrogen, were of sensibly greater mass than others, we would have the means of producing a separation between molecules of different masses and in this way we should be able to produce two kinds of hydrogen, one of

which would be somewhat denser than the other. As this cannot be done, we must admit that the equality which we assert to exist between the molecules of hydrogen applies to each individual molecule and not merely to the average of groups of millions of molecules."

But now that Harkins has been able to separate hydrochloric acid gas into denser and rarer portions by simply passing it through a series of church-warden tobacco pipes, Maxwell's argument proves the reverse of what he thought.

Energy, like matter, has come under the atomic theory, and here, too, we are becoming acquainted with its individual units. As Millikan catches and counts the electrons on suspended droplets, so Silberstein catches and counts the quanta of light on Trivelli's silver bromide crystals. A single quantum of light knocks out an electron from a molecule and so disturbs the equilibrium of the salt that the whole crystal can be reduced to the metallic state by a developer. A faint light hits only a comparatively few crystals here and there upon the sensitive plate. A longer exposure hits some more. So Silberstein concludes that light comes like scattered raindrops, not in a continuous stream. I gather from this that we should not speak of "a flood of light," for according to Silberstein it never pours but it rains.

Possibly these wavy arrows of actinic rays, which knock off electrons so easily when they hit a metallic target, may instigate in the same way other or all reactions started by light. This may be the signal that starts the machinery going in the carbohydrate factory of the green leaf. If so, we may learn to better nature in this business as we have in others and set up solar engines of our own.

The chemist provides the motive power of the world, the world of man, not the inanimate globe. Archimedes said he could move the world if he had a long enough lever. The chemist moves the world with molecules. If he can only get control of the electron, he will be in command of unlimited energy. For in this universe of ours power seems to be in inverse ratio to size and the minutest things are mightiest.

When we enter the realm of intra-atomic chemistry, we get behind the elements and may effect more marvelous transformations than ever. The smaller the building blocks the greater the variety of buildings that can be constructed. The chemistry of the past was a

kind of cooking. The chemistry of the future will be more like astronomy; but it will be a new and more useful sort of astronomy such as an astronomer might employ if he had the power to rearrange the solar system by annexing a new planet from some other system or expediting the condensation of a nebula a thousand times.

But if the chemist is to become an electron astronomer, he will have to become a methematician of the highest order. He may even have to enter the fourth dimension. In the good old days a chemist did not have to know any mathematics but arithmetic and that only as far as percentage and the rule of three. He had nothing harder to do than to figure out his analyses so as to add up to 100 per cent., and he did not dare to bring them out exactly to 100 because that would look suspicious. But some twenty years ago it became apparent that the chemist could not keep up with the progress of his science unless he passed in mathematics beyond the eighth grade. It was then that I dropped out of chemistry and took to journalism, a field that so far has not been invaded by the mathematician.

The constructive chemist must often begin by destruction. He must shatter this sorry scheme of things in order to remold it nearer to his heart's desire. To effect the disintegration that must precede the reintegration, the most useful agencies are high temperature and pressure.

The Fuel Problem.

The strike has brought home to us the fuel question—since it does not bring home the fuel. The expansion of population and the development of civilization, even their maintenance at the present standard of life, depend upon finding new and perpetual sources of mechanical energy. The paramount importance of this question has been recognized by the International Research Council, which at its Brussels' meeting on July 25 adopted, as one of three subjects for co-operative study by the twenty nations represented, the investigation of the energy supply of the world. This was a project recommended by the National Research Council of the United States, which presented a plan for the systematic survey of all possible and conceivable means of obtaining mechanical power for the purpose of ascertaining which seem sufficiently adequate and feasible to warrant special research. In this international investigation of the dynamic foundations and future of our civilization, the American Chemical Society

is qualified to take a leading part. No achievements would be better worth our $25,000 prize than a discovery opening up a new source of mechanical energy.

All our food and all our fuel, all our muscular and machine power, depend upon the peculiar ability of the little green granules of vegetation to build up carbohydrates out of air and water. The green leaf reaction—or, if you insist upon having it in Greek, the chlorophyl reaction—is the sole support of all plant and vegetable life and without it the earth would be a desert planet like the moon.

If the work of the world were really done by "horse power," as we still call it, man would have reached the limits of civilization a hundred years ago, for a horse requires hay and hay requires land and there would not be enough land in the world to provide for the horse power we are now using. Supplementing the green fields with the coal fields, man has not only prevented civilization from coming to a stop, but has given it an unprecedented forward impetus. The iron horse feeds on subterranean pastures. He is living on crops of the Carboniferous Era. Modern civilization basks in the sunshine that fell upon the earth unmeasured millenia ago. We are living on our capital, drawing on the coal banks. Sometime we must begin to earn our own living, to grow our fuel as we go.

Meantime, the amount of solar energy that is being stored up in the plants every summer is ten times as great as that released by the combustion of coal. But coal is more condensed and convenient than wood. Oil and gas are still better fuels. It would seriously check the progress of civilization if the world had to return to the wood basis as it was 150 years ago.

We have been wasting year by year half of our natural gas and three-quarters of our petroleum. The supply of gas has fallen off by a quarter in the last five years, and soon will be running short. Our oil reserves will not last long, fifteen or twenty years at the present rate of consumption is all the geologists will allow us. At any rate the gasoline tank is getting low and no service station is in sight.

Still the trees and tiny plants flaunt their foliage provocatively in the face of the passing scientist, who must confess that he cannot yet accomplish what they do so easily—these little green-leaf laboratories, these filmy factories, noiseless, smokeless, odorless, that with no reagents but air and water and no power but the sunshine build

up by the ton the most complicated carbohydrates out of the simplest compounds of the commonest elements, carbon, hydrogen and oxygen.

Still, the sun, sole source of all our life and weather, floods half the earth with its rays, and the land that receives the most of this potential wealth is the land that retains the least of it, the arid region of the tropics. A section of the Sahara, forty miles square, receives in six hours a day as much heat as is produced by the coal burned in the twenty-four hours throughout the world. If only a small fraction of this wasted energy could be economically stored up and set at work by some sort of solar engine, we need not worry about the exhaustion of our oil, gas and coal. There would be wealth enough for all.

Here, then, is the greatest problem of conservation, the kind of conservation that consists in utilization. But, being accustomed to such wasefulness, it does not excite attention. Nobody is bothering about it except a few chemists, and they do not know how to help it.

Every tiny grass blade points the finger of scorn at the chemist and says "Se how we do it. Don't you wish you could?"

And the chemist, with command of pressures varying from a vacuum to the point where steel flows like tar, and with command of temperatures ranging from the boiling point of carbon almost to absolute zero, is still obliged to confess that he cannot accomplish on a commercial scale the simple reaction of the polymerizing of formaldehyde. Even if he knew how, he could not hope to compete with plants on their own ground because they have at their command free raw materials and the cheap labor of protoplasm. Even a professor of chemistry cannot live as cheaply as a cornstalk.

But there are as many celluloses as there are sugars and it is not probable that those that the plants have prepared for their own purposes would be the best for all human purposes. Just as we have found that better dyes and drugs can be made in the factory than can be found in nature, so we may surmise that some of the fundamental foodstuffs—starches, sugars, fats and even proteins—may possibly be improved upon.

More important and promising than the possibility of synthetic food is the possibility that we may devise some better method of capturing solar energy than the plants have hit upon. We have no reason to assume that the carbohydrates are the only way of solidify-

ing sunshine. The chlorophyl process is shockingly wasteful. Less than one per cent. of the solar energy that falls upon a leaf is fixed in the form of carbohydrates, from which it may be later released by oxidation. The crude steam engines, set up in Egypt, catching sunshine by cylindrical mirrors and throwing the heat upon blackened water pipes, have an efficiency of some four per cent., much higher than the green plant.

But a steam engine at best is an inefficient machine, and now that we are able to guide streams of electrons where we will and sort them out according to speeds by means of grids acting like Maxwell's demon, we may reasonably hope to utilize the radiant energy of the sun directly for power purposes. This is not a visionary project such as drawing upon the exhaustless forces inside the atom. That may, for all we know, remain forever an impossibility. What I am talking about, the fixation of solar energy, is something that we know can be done, for we see it in the grass every sunny day. If sunshine can excite a selenium cell and decompose silver bromide on a photographic plate, it may be made to do work of another sort and on a larger scale. Here, at any rate, is the greatest problem that the world presents, and the highest prizes are offered for its successful solution.

"Experiments of Light."

I suppose that all of us have tried erratic experiments that we would not care to confess before our colleagues in such an assemblage as this. Crazy ideas will pop up in the best-regulated brains from some subconscious cellar, and we try them out on Saturday afternoon when there is nobody else around, just to see what will come of them. They do not appear in our published reports—unless they happen to succeed—in which case we claim full credit for our foresight in undertaking an operation that ordinary minds would have condemned in advance as absurd.

Now it is interesting to observe that such irrational experimentation is distinctly recommended by the philosopher who laid down the laws of experimental science that have in the three centuries since accomplished such amazing achievements. Lord Bacon, after listing in his precise and orderly manner all the various ways that we may be guided in our researches by theory, observation and previous experiment, concludes quite unexpectedly by adding a new category, what he calls the experiments of a madman, and defines as follows:

"When you have a mind to try something not because reason or some other experiment leads you to it, but simply because such a thing has never been attempted before. The leaving I say of no stone in nature unturned. For the magnalia of nature generally lie out of the common roads and beaten paths so that the very absurdity of the thing may sometimes prove of service. But if reason go along with it, that is, if it be evident that an experiment of this nature has never been tried, then it is one of the best ways and plainly shakes the folds out of nature."

The example Bacon gives of such unprecedented experiments is of peculiar interest to us:

"But of what I may call close distillation no man has yet made trial. Yet it seems probable that the force of heat, if it can perform its exploits of alteration within the enclosure of the body, where there is neither loss of the body nor yet means of escape, will succeed at last in handcuffing this Proteus of matter and driving it to many transformations; only the heat must be so regulated and varied that there be no fracture of the vessels.

"No one should be disheartened or confounded if the experiments which he tries do not answer his expectation. For though a successful experiment be more agreeable, yet an unsuccessful one is oftentimes no less instructive. And it must ever be kept in mind (as I am continually urging) that experiments of Light are even more to be sought after than experiments of Fruit."

What Bacon was "continually urging"—that "experiments of Light," those that lead to enlightenment on fundamental principles, "are even more to be sought after than experiments of Fruit," those that bring practical results—needs more than ever to be kept in mind at the present day, when public and employers are impatient of research that does not bring immediate and profitable returns. So it is worthy of notice that the example which Bacon cites as the experiment of a madman—that is, destructive distillation—has been peculiarly productive of both Light and Fruit. Applied to coal, it has given us coke for metallurgy, gas for cities and shops, and coal-tar products of innumerable variety and inestimable value. Applied to petroleum, it has increased the yield of gasoline by some 2,000,000 gallons a day. By thus "handcuffing this Proteus of matter and driving it to many transformations" we have gained an insight into the structure of the molecule and the chemistry of life.

An Agent for Democracy.

Chemistry is the most effectual agent for democracy, since it actually accomplishes in regard to many material things that equality which legislation aims to bring about in the political sphere. Luxuries, formerly the monopoly of the privileged classes, become, through applied science, the common property of the masses. The "royal purple" of the ancients and dyes far more beautiful are now to be had on the bargain counter, and Solomon in all his glory was not arrayed like the modern American maiden. Even though her purse be scant she need not lack jewels and perfumes and fine raiment such as once were worth a slave's life. In early ages the man who owned a piece of steel shaped it into a sword and made himself master of his fellows. Now we make buildings out of steel and he who lives in the garret of one of them could look down on the tower of Babel. The Feudal Age vanished at the first whiff of gunpowder, for that device of the Black Art leveled the natural and the artificial inequalities of humanity in warfare, for with a gun in his hand the churl could meet the knight on equal footing and the dwarf was match for the giant—more than a match, for he had the larger target. Medicines such as a prince could not have procured, though his physicians surveyed the earth from China to Peru, are now at hand to cure the pauper. The new chemical motive powers have given man in the automobile a very fair substitute for the seven-league boots of the fairy tale; they enable him to go down into the sea in ships on more or less lawful occasions, and they have endowed him with the wings that he has always longed for but never expected to get until he reached Heaven. Books are no longer chained up in treasuries, but, manifolded by the magic of ink, are to be bought on the street corner like peanuts; pictures from the private gallery of prince or plutocrat are multiplied by the same mechanism and scattered throughout the land. We do not have to pay ten dollars to hear one song by Galli-Curci since we can hear her at home with as many encores as we like. Caruso, though dead, yet speaketh. His voice has been embalmed by carbolic acid. Events that few could witness are brought to all of us on the celluloid film. So, whether it be the satisfaction of our material wants or the gratification of our aspiration for art and literature, the chemist acts as the agent of applied democracy. Democracy has been engaged in a struggle for life lasting five years and has

emerged triumphant—thanks to the chemist. For war has now become essentially a branch of applied chemistry, carried on almost entirely by chemical weapons and chemical defenses. Germany, regarding herself as the heaven-born leader of mankind in this science, attempted to use it to establish her political supremacy in the world, but in spite of her advantage at the start she was foiled in the end by the democratic nations. She had freed herself in advance from dependence upon the nitrate beds of Chile for her explosives by developing methods of making nitrates from the air.

The war is over and Germany has been relieved by the Allies of the burden of armament that still weighs upon the victorious nations. But Germany, unlike the United States, finds it profitable to proceed with the Haber process even in time of peace. We need have no fear of such a catastrophe as the explosion of Oppau. If the Muscle Shoals plant should blow up now, the loss of life would be considerably less. It is curious to recall that the allied aviators were never able to blow up the Oppau works despite their gallant and persistent attempts, yet now the Germans without ouside aid have removed the entire establishment from the earth with the greatest ease. The moral of this is the old maxim, "If a thing is to be done, do it yourself."

The Washington Conference on Reduction of Armament decided to prohibit the toxic forms of chemical warfare, but not the explosive. Consequently, we cannot use gases against our foreign foes, though they may be still employed against our own people when disorderly. Even the comparatively mild lachrymatory and sternutatory gases are officially debarred. We may use chemicals to draw blood from our enemies but not to draw tears. Our military authorities seem determined that the American Army shall never be sneezed at.

Whether this paper prohibition will hold against an unscrupulous or desperate enemy or whether our soldiers may some day be caught unprepared as were the British at Ypres, must be left for time to determine. But since the chemists of the country are not responsible for the risk, they may rejoice in the meantime at being relieved of the distasteful task of devising modes of destruction and concentrate their attention upon the constructive side of their science.

Sociological Influence.

The chemist is not merely a manipulator of molecules; he is a manager of mankind. His discoveries and inventions, his economies and creations, often transform the conditions of ordinary life, alter the relations of national power, and shift the currents of thought, but these revolutions are effected so quietly that the chemist does not get recognition for what he accomplishes, and indeed does not usually realize the extent of his sociological influence.

For instance, a great change that has come over the world in recent years and has made conditions so unlike those existing in any previous period that historical precedents have no application to the present problems, is the rapid intercommunication of intelligence. Anything that anybody wants to say can be communicated to anybody who wants to hear it anywhere in all the wide world within a few minutes, or a few days, or at most a few months. In the agencies by which this is accomplished, rapid transit by ship, train or automobile, printing, photography, telegraph and telephone, wired or wireless, chemistry plays an essential part, although it is so unpretentious a part that it rarely receives recognition. For instance, the expansion of literature and the spread of enlightenment which put an end to the Dark Ages is ascribed to the invention of movable type by Gutenberg, or somebody else, at the end of the fourteenth century. But the credit belongs rather to the unknown chemist who invented the process of making paper. The ancient Romans stamped their bricks and lead pipes with type, but printing had to wait more than a thousand years for a supply of paper. Movable type is not the essential feature of printing, for most of the printing done nowadays is *not* from movable type, but from solid lines or pages. We could, if necessary, do away with type and press altogether, and use some photographic method of composition and reproduction, but we could not do without paper. The invention of wood-pulp paper has done more for the expansion of literature than did the invention of rag paper six hundred years ago.

For the conveyance of ideas the picture is often more effective than the word and here the photographic processes of multiplication due to the chemist are the essential factors.

It is interesting to live at a time when we can witness the birth of a new art. Such was the last quarter of the fifteenth century when the art of printing books was being developed. Such is the first quarter of the twentieth century when the art of depicting motion is being developed. In fact, the moving picture has a better title to the term "a new art" than had printing, to which it was applied so long ago. Printing was not so much a new art as a mechanical extension of an old art, one of the oldest and best developed of the fine arts, the art of calligraphy. The first printed books were but cheap and inferior imitations of the handsome handwritten volumes of that day. Even today with four hundred and fifty years of progress it is in cheapness and convenience rather than beauty that the modern book surpasses the ancient manuscript.

Now in the same way the moving picture does for the drama what printing did for literature, that is—it brings it within reach of the multitude through a process of mechanical manifolding. But it does something vastly more important than this. It makes possible for the first time the unlimited reproduction of actual events. This world of ours is a moving world and no static art can adequately represent it. There is no such thing as still life, or still anything else in the whole universe. Everywhere and always there is motion and only motion and any representation of reality at rest is a barefaced humbug. The more realistic the painting or sculpture the more obvious the failure. Myron's "Discobolus" and Meissonier's "Friedland" are as unnatural and fictitious as a centaur or a hippogriff. The most beautiful painting ever put on canvas, the finest statue ever carved, is a ridculous caricature of real life compared with the flickering shadow of a tattered film in a backwoods nickelodeon. We have now for the first time the possibility of representing, however crudely, the essence of reality—that, is motion. Bergson has shown us what a paralyzing influence static conceptions of reality have had upon the history of philosophy and how futile have been all attempts to represent movement by rest. The scientist of today thinks in terms of motion. All modern thought is assuming kinetic forms and we are coming to see the absurdity of the old ideas of immutability and immobility. A similar revolution is impending in art. At least we glimpse the possibility of a new form of pictorial art, which, if capable of development as it seems to be, will make our present pictures appear as grotesque as the reliefs carved on Egyptian tombs or the

scrawls on the caverns of Altamira. What will our posterity, familiar with moving portraiture, think of our admiration of Mona Lisa's smile, frozen on her lips for four centuries? A smile is essentially a fleeting thing, an evanescent expression. A fixed smile is not a smile at all but a grimace. It is only by the most violent effort of the imagination that we can ignore the inherent artificiality and limitations of painting sufficiently to get from it the illusion of reality.

Metaphysics of Chemistry.

In considering the contributions that chemistry has made to our wealth and comfort, we must not forget that every fundamental discovery alters also our attitude toward life and consequently our conduct. There is a metaphysical as well as a physical side to chemistry. The new conceptions of the atom and of the sidereal universe, of matter and energy, of time and space, developed within the last ten years, will inevitably transform the prevailing modes of thought in philosophy, religion, and sociology as much as did the Copernican idea of the moving earth in the fifteenth century and the Darwinian idea of developing species in the nineteenth century.

The theory that the heat of the stars comes not from gravitational contraction but from such intra-atomic sources as the formation of helium from hydrogen has extended the life of our sun by some thousands of millions of years, and thereby the limitation of life on the earth and the possibility of the development of a superior civilization. So we don't have to hurry so hard as we did when we thought that the sun was a guttering candle, likely soon to flicker out and leave us in the dark and cold. We used to watch with anxiety the periodical reports of Langley and Abbott as to the constancy of the solar constant in order to see how much more time we had to perfect our social system before night, for when we looked at the daily papers we did not seem to be making progress very rapidly and it looked as though we should all be Eskimos before we got our society to suit us.

The mind is supposed to be immaterial but it seems to be possessed of inertia. The more quickly you want to move the mind of man the greater the power that it is necessary to apply. To move the mental mass of the nation greatly requires almost infinite expenditure of energy or almost infinite time. Since scientific men devote

very little energy to the propagation of their views, it takes a very long time for new scientific ideas to act upon the popular mind. There is consequently a lag in the progress of civilization, a break in the line of march between the vanguard and the rank and file.

This is largely due to the lack of efficient terminal facilities in the delivery of intelligence. Transportation experts tell us that often a larger part of freight charges is consumed in the short haul between station and home than in the long haul by ship or train. So it is in the transmission of ideas. An idea may be sent around the world at the rate of 186,000 miles a second, but the short haul between the eye or ear and the brain may require twenty years. If the message is in a foreign language, such as scientific terminology, and there is no translator about, the reception of the intelligence by the average mind may be indefinitely delayed.

Need for Popularization.

Chemistry has long since abandoned the pretension of being a secret science, but it has not yet become a public science. It has the air of being much harder to understand than it really is. Its symbols are almost as repellant to unfamiliar eyes as are the mathematical signs of physics. The verbal formulas, by which compounds are designated, are mistaken for names and considered unpronounceable. But such impediments to popularity are not peculiar to chemistry. Other sciences, quite as much handicapped by strange nomenclature and recondite conceptions, are nevertheless read with eagerness by the public. Astronomy, which is largely mathematical and has no practical value for the reader and does not deal with human beings or any living thing, is still one of the most popular of the sciences. We have to put an astronomical article into our *Science News Bulletin* every week to satisfy the newspapers to which it is syndicated, but if we omit a chemical article we get no complaints.

One reason why the public is not so much interested in chemical research as it ought to be is the lack of writers willing to translate the science into ordinary English and present it in an attractive style. I speak with some assurance on this point for it has been my business, ever since Science Service was founded a year and a half ago, to hunt for people trained in the several sciences who can and will write about them for newspapers and magazines,

and I have found it more difficult to get good writers in chemistry than any of the other sciences. Yet there are more chemists in the country than any other scientists. Not all of them are so absorbed in research, teaching, or industry, that they could not find a leisure hour for writing once in a while. I can find plenty of people to write about birds or bugs, clouds or stones, crinoids or endocrines, stars or starfish, but I find few who will tell the thrilling continued story of chemical discovery.

Yet no science touches human life more intimately than chemistry. None is of more practical importance in industry. None is turning out more sensational novelties. None has a more varied and romantic history.

Of its technical literature chemistry may well be proud. The three journals of this Society, and especially our system of abstracts, are the envy of all the other sciences, and there are various other able and attractive journals of chemical science and industry. But these are read exclusively by chemists and there is no popular periodical of chemistry published anywhere in the world. In the popular science periodicals and in the scientific articles of the general magazines, chemistry does not fill as large a space as its practical importance and intrinsic interest demands. At least so it seems to a chemist. The chemical news service of this Society is doing a splendid work in preading chemical information through the newspapers, and the Local Sections are bringing our science to the attention of the public by their meetings, but there is need for other kinds of chemical literature, especially for magazines and books. Last year the Washington Academy of Sciences prepared, at the request of the Washington Public Library, a list of One Hundred Popular Books in Science. In many fields, such as botany, astronomy, paleontology, entomology, and the like, there was an embarrassment of books to choose from, but when it came to the science of chemistry Dr. Sosman, chairman of the committee, reported that not one could be found. There were several popular books on special topics, such as the chemistry of commerce, industry and everyman's life, but none that treated the science as a whole and satisfied the requirements of the selection, which were that the book should be readable by the ordinary reader, not a textbook, not a reference book, not a home study course, but so written that it would interest one who had no previous knowledge of the

subject and no special reason for wanting to know about it. It is worthy of note that the committee had to go abroad for some forty per cent. of its popular science books, and that several of them were over fifty years old, although a recent book would be preferred. Yet some of these British books find their greatest sale in the United States, notwithstanding the advantage that an American writer has in local references and colloquial language. It would seem that a hundred million readers might reasonably expect to have one popular book in each science once in fifty years in order to keep within sight of scientific progress.

I would not take up so much of your time with my business, but it is your business, too—at least I hope to persuade you that it is. I am glad to see that you have already taken a step that will aid in the popularization of the science by organizing a Section of History of Chemistry. For one of the reasons why science is caviar to the general public, is that it has been so conscientiously depersonalized. The effort is constantly made to reduce science to a set of mathematic formulas, free from all taint of time, place, and personality, bearing no trace of its erratic history and early gropings in the dark. This is quite a proper procedure for the development of the science, no doubt, but it has the unfortunate effect that in eliminating the human element you have eliminated the human interest. C. P. sucrose is a beautiful product, a triumph of technology in which the Division of Sugar Chemistry may well take pride, but it is not so tasty as maple sap or cane juice. It has lost its vitamins. That, I think, is why pure science is distasteful to the layman. It has lost its vitamins. To put a modern, high-grade textbook in the hands of the ordinary reader is like feeding decorticated rice to a soldier. It gives him mental beriberi. I hope I will not be misunderstood as saying anything against the chemist's constant efforts to achieve a higher degree of purification. Perfect purity is a noble aim even though it be asymptotically unattainable to human beings. There was once a little girl who prayed: "O God, make me pure; make me absolutely pure like Royal Baking Powder!" Now it does not do any harm for baking powder to be pure because it gets mixed with so many other things, but if the flour is absolutely pure, and the fat, and the salt, and the water, well, somehow the bread is not so nutritious as it might be.

I am not sure than even in a textbook a bit of history or a few personalities would be out of place, though they might give the student the idea that the principles of the science have been worked out by slow degrees and much blundering by fallible human beings instead of being handed down in perfect form on tables of stone like the Ten Commandments. But anyhow, I am sure that for the general reader it is best not to refine too highly but to leave in a little of the human alloy. And I hope that your Section of History will develop some young writers who will turn out a readable character sketch of the creators of chemistry, or a dramatic description of how their discoveries were made and what they mean to the world. One can get such "human interest stories" in abundance about authors, artists, musicians, statesmen and warriors, but I have been searching in vain for writers who would do as much for science. Until such writers are found we cannot expect readers in general to take as much interest in science as they do in literature, fine arts, politics, and war.

POND LIFE.*

By John Rae, M. P. S.

Many pharmacists and students are no doubt owners of microscopes, but are probably unaware of the infinite variety of objects to be found in pond water. An ordinary student's microscope is all that is necessary for the work, unless one wishes to see such things as the fine markings on diatoms, for which a high power is necessary. When collecting the water collect a little of the mud, and also plenty of pond weed, which will keep the water sweet. On returning home empty the water into a large glass jar—jam jars do very well; the mud will soon sink to the bottom, leaving the water quite clear, with the weed floating on top. If the water is now examined in a good light, quite a number of minute animals are to be seen with the naked eye, such as the cyclops and water-flea. By means of a dipping-tube transfer some of the water to a small watch-glass; from this the objects are easily lifted with a fine brush to a slide which is slightly hollowed out in the centre, or to a live box.

* Reprinted from *Pharm. Journ. and Pharm.*

Cyclops and Other Species.

Under even a very low power the cyclops, one of the *Copepoda,* so called from the one big eye in the centre of its head, looks quite terrifying, having the appearance of being encased in a coat of armor. The female is easily distinguished by the presence of two large egg sacs, one on each side.

The water-flea, *Daphnia Pulex,* is perhaps more interesting than the cyclops, owing to the fact that it is quite transparent, and gives one the impression of watching the movements of a very complicated watch.

Amongst the comparatively large objects are curious-looking larvæ of certain insects such as the dragon-fly and others of the mosquito type, which during their wonderful metamorphosis from egg to perfect insect spend part of their life as humble pond dwellers. The tail, by means of which they dart about with great rapidity, is well worth examining, also the head, which in some species is somewhat like a monk's cowl.

If a drop of what would appear to be perfectly clear water is taken from the specimen jar and placed under a moderate power, the water appears to be full of minute, almost transparent objects, which seem to be constantly moving along at what for their size must be a great rate. These animalcula are easily found in water in which dry hay has been soaked for a few days. They are very low in the scale of evolution, and were made use of by the exponents of the doctrine of spontaneous generation.

Vorticella.

One of the most beautiful objects to be found in pond water is a colony of bell animacula, or *Vorticella.* If the stem of a piece of water weed is placed under the microscope and left undisturbed for a few minutes, the field will probably be found to contain some transparent, cup-shaped objects, which are attached by means of long stalks to the stem of the weed. Cilia, which move at a great rate, cause a current of water to be constantly passing the mouth. This current of water, containing a supply of food material, is easily noticed by means of particles which are floating in it. The sea anemone, familiar to all lovers of natural history at the seaside, obtains its food

in a somewhat similar manner. *Vorticella* are extremely sensitive, and the slightest movement of the microscope is sufficient to cause the thin stalk to contract, when they become almost invisible. This explains why it is necessary to wait for a short time after transferring them to the slide before they gain sufficient courage to appear.

Rotifera,

or wheel animalcula, are to be found in abundance in pond water, and also in rain-water cisterns. Some of them attach themselves to pieces of wood or pond weed. Rapidly-moving cilia give one the impression that the head is constantly revolving. They are extremely hardy, and during drought are able to live encased in dry mud for long periods.

Volvox Globator,

a fresh-water unicellular plant, which attains a diameter of about one-twentieth of an inch, has the appearance of a ball covered with a fine network. The next generation is visible as free swimming plants in the cavity of the parent, where they remain until it dies and the outer wall is ruptured.

Other Objects.

Other objects to be looked for include *Ulothrix Zonata,* a fresh-water plant, which one may be lucky enough to see in a state of conjugation. Also *Pandorina Morum,* and *Nostoc,* a curious long green filament composed of a chain of cells, the regular character of which is broken at intervals by the presence of a large inert cell called a heterocyst. An allied object is *Oscillaria,* which, as its name implies, is constantly oscillating like the pendulum of a clock. When watching it one is almost hypnotized by its regular steady movement.

So far only the extreme edge of one of the most interesting pastimes has been touched, but when once commenced the study of pond life becomes so engrossing that when a colony of *Vorticella* are under observation one quickly becomes oblivious of time, hunger, and fatigue.

AN INVESTIGATION OF THE ALKALOID COLCHICINE: ITS ASSAY, ISOLATION AND SPECIAL PROPERTIES.*

By E. C. Davies, M. Sc., M. P. S., and James Grier, M. Sc., Ph. C.

At last year's meeting, at Scarborough, of the British Pharmaceutical Conference, a paper on "The Assay of Colchicum by the Phospho-Tungstic Method" was contributed by E. C. Davies (*vide* Year-Book, 1921). The present contribution is a further development of the subject, and deals with the isolation in quantity of colchicine and with its assay by volumetric and gravimetric methods with Mayer's and Schiebler's reagents, and also by colorimetric methods, and finally with the special properties and reactions of the alkaloid. In the *isolation of colchicine* in quantity from the seeds and corms satisfactory precipitation of the alkaloid by phospho-tungstic acid was found to be possible only in presence of sodium chloride along with acid, and as the result of experiments systematically carried out it was found that 0.5 per cent. HCl plus 2 per cent. NaCl gave the best results, and represents the ideal conditions for such precipitation. The much weaker acid required also lessens the risk of alteration of colchicine. The seeds and corms were first exhausted with industrial methylated spirit in a special Soxhlet apparatus with the boiling flask placed at the side, not underneath, so as to avoid exposure of the powdered drug to heat, and also to obtain thorough exhaustion with the minimum amount of solvent. 150 gms. of powdered drug were thoroughly exhausted with 350 cc. of solvent during three days or less, the alcohol was recovered, the residue extracted with hot water, any oil present shaken out with ligroin, and the impure alkaloid shaken out with chloroform. The dark colored chloroform residue was again extracted with hot water, and the filtered yellowish-green liquid precipitated with phospho-tungstic acid in presence of 2 per cent. NaCl and 0.5 per cent. HCl. The yellow granular precipitate was collected on filter paper and washed free from NaCl wth 0.1 per cent. HCl, then rinsed into a separator containing chloroform, ammonia added in slight excess, the chloroform washings evaporated and the residue taken up with q.s. 50 per cent. alcohol and dried on

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plates. The product was yellow with m.pt. 144° C., and very readily and entirely soluble in water, indicating its purity. A specimen of Merck's pure colchicine from the Materia Medica Museum of the Manchester University gave a m.pt. of 142° C. It was yellow in color, and when tested by the phospho-tungstic method indicated 97.6 per cent. purity. No difference was found in the colchicine from the seed and corm. A commercial specimen of so-called pure colchicine proved on examination to be an impure form of colchicine tannate with m.pt. 120° C. The phospho-tungstic method of isolating colchicine is a great improvement on the older method (see Remington) of precipitating with tannin and digesting the tannate with lead oxide, which method gives a dark brown resinous mass soluble in water only with difficulty. It was found that by decomposing the colchicine tannate in 10 per cent. alcoholic solution with lead nitrate solution, then the excess of lead with dilute sulphuric acid, and finally shaking out with chloroform, a light brown product, m.pt. 140° C., was obtained.

Zeisel's method, which consists in repeated solution of the alcoholic residue in water and shaking out with chloroform so as to ob-
then regenerating the alkaloid by heating with q.s. water at 50° C.,
tain the chloroform addition compound $C_{22}H_{25}NO_{6}2CHCl_{3}$, and
gave a light brown amorphous product with m.pt. 136° C.

The relative value of different *solvents* in the extraction of colchicine was investigated. Using the Soxhlet apparatus, it was found that chloroform, ethyl alcohol, methyl alcohol, and methylated spirit gave complete extraction in three to four hours, using 10 gms. of powdered seed and 100 cc. solvent. In six hours ether and benzene extracted 80 per cent. of the colchicine present, and carbon tetrachloride 72 per cent.; while in twelve hours amylic alcohol extracted only 53 per cent. In all these cases the colchicine was a dark brown resinous mass, indicating the advantage of purification by precipitation by the iodine or phosphotungstic method. Based on the above experiments a rapid but not absolute process of assay was devised where the alcoholic extract was extracted with hot benzene, and subsequent shaking out with N/10 acid and then with chloroform. It indicated 87 per cent. of the colchicine present.

Volumetric methods of assay with Mayer's reagent were carried out in 2 per cent. H_2SO_4 solution, using Merck's pure colchicine

for the purpose. The centrifuge was utilized to get rapid and complete separation of the precipitate, and so enabled the estimations to be carried out more rapidly and with greater delicacy as compared with the old slower method of gradual precipitation with filtration after each addition. 1 cc. of N/20 Mayer = 0.011 gm. colchicine (Merck), which corresponds closely with the empirical figure 0.0147 given in Lyons' "Assay of Drugs," page 143. Volumetric assay was also carried out with Schiebler's reagent in presence of 1½ per cent. H_2SO_4 with the aid of the centrifuge. The precipitate so obtained was also ignited, decomposing at 200° C. into $P_2O_5 2OWoO_3$. Precipitation with Schiebler's reagent was also done in presence of 2 per cent. NaCl and 0.5 per cent. HCl. In this case the precipitate was granular (that got with H_2SO_4 alone was not), and could be collected, washed and dried on a filter paper without the aid of the centrifuge. It was then ignited. The results of these volumetric and gravimetric estimations carried out with Schiebler's reagent established the ratio of 1 of colchicine to 3.3 of phosphotungstic acid as the proportions by weight in which they combine, and this agrees closely with the formula of four molecules of colchicine to one molecule of phosphotungstic acid. Heiduschka and Wolff (Year-Book, 1921) find the ratio to be 1:3 with less than 1 per cent. HCl, and indicate that for aconitine and nicotine this method is preferable to the silicotungstic method.

Method of estimation by *Nesslerising*. Both acid and alkali give yellow colors with colchicine, but that with alkali—particularly KOH —is more intense, indicating a dye-structure probably. In fact, colchicine may be used as an indicator. With weak, *i. e.*, N/10, acid no color is appreciable, but one drop in excess of N/10 alkali produces a greenish tint. The intensity of the color, faint green to dark olive green, using dilute solutions of colchicine, depends on the strength of the alkaloidal solution, 0.008 per cent. representing the limit of color production. The method is quite reliable within the limit stated, and may be used to estimate colchicine in dilute solutions *colorimetrically*. It is simpler and more easily applied than the $FeCl_3$ and HCl colorimetric method suggested by Fabinyi in 1912. The acid color is easily removed by chloroform, but is not affected by NH_4Cl; the alkali color, on the other hand, is difficult to remove by chloroform, but is immediately decolorized by NH_4Cl.

Properties and Reactions of the Alkaloid Colchicine.

Colchicine, $C_{22}H_{25}NO_6$, occurs in pale yellow flakes, or as a pale yellow amorphous powder, with a bitter taste, and giving off a haylike odor when damped and warmed. Dose, 1/20 to 1/30 grain; lethal dose, .0012 gm. per kilo body weight. M. pt. U. S. P. viii, and B. P. C. gave 142.5° C., but 145° C. that of the French Codex, was recommended for U. S. P. ix, which has adopted 142° to 146° C., and this range includes the melting points 142° C. and 144° C. obtained in this investigation. Merck (Year-Book, 116) says pure colchicine forms white amorphous flakes, m.pt. 142-147° C., which, from its aqueous solution, deposits large yellow crystals of the sparingly soluble hydrate $(C_{22}H_{25}NO_6)_2.3H_2O$. Fuller gives 120° C. for the crystalline form, and 140-145° C. for the resinous (amorphous) form. As the yellow color, on exposure to light and air, becomes dark brown, colchicine and its "salts" should be stored in well-stoppered amber bottles in a dark place. It is soluble in water 1 in 22, the solution being neutral to litmus and lævorotatory, less soluble in warm water 1 in 26 at 80° C., very soluble in chloroform, methyl alcohol, methylated spirit, and in 90 per cent. ethylic alcohol, but less so in absolute alcohol. It is not very soluble in benzene 1 in 87, or in ether 1 in 155, still less in carbon tetrachloride and amyl alcohol, and insoluble in petroleum benzin. It is soluble in glacial acetic acid to form a colorless liquid which dries to a colorless transparent varnish; in fact, acetic acid is a good solvent. In acetic solution it exists as the single molecule, but in aqueous solution it occurs as the double, or even the triple, molecule (Zeisel and Stockert). Colchicine forms addition compounds with chloroform, bromoform, and ether, which compounds are decomposed at 100° C., or, when warmed with water, at 50° C., in the latter case with formation of the hydrate. Chloroform extracts it completely from acid solutions, distinction from berberine, one of the few other yellow alkaloids. With alkalies it forms yellow resinous compounds, which are difficult to resolve with chloroform; in fact, it is essential to have the chloroform present before shaking out with alkali. Warmed with dilute acids or alkalies, it yields methyl alcohol and colchiceine. On account of the ease with which colchicine is hydrolyzed, it is probable that colchiceine is present to a greater or less extent in most of the colchicine residues obtained in analytical work (Fuller, "Assay of Drugs").

Colchiceine, $C_{21}H_{23}NO_6.\frac{1}{2}H_2O$, occurs in shining white needles. M. pt. 172° C. (anhydrous), 140° C. crystals. Fuller gives 160°-170° C. Soluble in alcohol and chloroform and in hot water, slightly in cold water, and solution is neutral and lævorotatory, almost insoluble in ether and benzene. It forms no crystalline addition compound with chloroform, but, like colchicine, it dissolves in acids, alkalies, and alkaline carbonates, with a yellow color; also, like colchicine, it does not combine with acids to form salts. Although Oberlin, who first obtained it (1856), thought it pre-existed in colchicum, Zeisel says it is only formed by decomposition of colchicine, produced as a result of hydrolysis on extracting the drug with acid menstrua. It has much the same physiological action as colchicine, but, according to Fuehner (1913), is very much less toxic.

Tests and Reactions of Colchicine.

The usual slab color reactions given with strong acids need not be mentioned, nor the precipitates given with the usual alkaloidal reagents, such as Mayer, Thresh, Marmé, except that arseno-, silico- and phospho-tungstic acids all give yellow precipitates, and that platinic chloride gives no precipitate, although gold chloride gives a crystalline double chloride. Bromine water also gives a yellow precipitate soluble in ammonia to an orange liquid. Colchicine is so readily converted into colchiceine by acids that some of the reactions attributed to colchicine itself are probably due to its decomposition product. Ferric chloride, *e. g.*, gives a dark green with colchiceine. When, therefore, $FeCl_3$ requires the addition of conc. HCl to give the green color with colchicine itself as in Fabinyi's colorimetric method, we may assume that colchiceine is formed. Colchicine solutions give no color with $FeCl_3$ in the cold, and, on heating, a brownish red. An alcoholic solution of colchicine gives with $FeCl_3$ solution a garnet red. Ammonium vanadate gives a reddish yellow with colchicine, but a dark purple color with colchiceine. If a mixture of 5 drops each of an aqueous solution of colchicine, fuming HNO_3 and $FeCl_3$ solution be heated to boiling, a yellow solution is formed, changing to olive green, and if the above mixture be shaken with chloroform the latter is colored ruby red and the aqueous solution remains green. Fuehner (1910) gave the following test for the toxicological detection of colchicine. 5 cc. of the solution are heated on a boiling water

bath for half an hour with 5 drops 20 per cent. HCl. On then adding 3 to 5 drops $FeCl_3$ solution a green color is produced. On cooling and shaking out with chloroform the latter is colored yellowish to permanganate red. 0.005 gm. will give the red tint; the green color is more sensitive, but alone, is not sufficiently characteristic. It was noticed in applying the tests for colchicine that (1) Ether containing SO_2 gave a canary-yellow precipitate, which reaction may also be used as a test for the presence of SO_2 in ether, (2) that ligroin or petroleum spirit precipitated from alcoholic solution a white compound, which at 100° C. reverted to the ordinary yellow variety, (3) that carbolic acid, cresol, and thymol as well as tannic acid and salicylic acid, gave precipitates with colchicine, and that, as all these are phenolic substances, it is evidently with the phenolic and not with the carboxylic grouping that the colchicine combines in forming the so-called tannate and salicylate, so that these compounds are *not* true salts. Picric acid gives no precipitate, but on adding acid a resinous mass is produced. Colchicine is used in relieving the pain in the acute manifestations of gout. It is thus a natural pain-relieving drug principle, and this analgesic action is associated with the presence in the molecule of an amido-acetic grouping, just as in the artificial analgesics, acetanilide, phenacetin and phenazone or antipyrine, which are used to relieve the acute pain of neuralgia and sciatica, and all of which also resemble colchicine in not combining with acids to form salts.

Preparation of the "Salts" of Colchicine.

The salts of colchicine, if they exist, are extremely unstable, being decomposed by water. Thus colchicine may be extracted from an acidulated solution by chloroform.

Colchicine Salicylate.—This compound is used medicinally and may be prepared by moistening a mixture of 20 parts of colchicine and 7 parts of salicylic acid and drying. It is a dark yellow, amorphous powder, easily soluble in alcohol, slowly soluble in water, and was found to have no sharp m.pt. The following experiments prove that if it is a salt, it is decomposed in solution:—(1) 0.2 gm. was dissolved in 20 cc. water and shaken in a separator with 10 cc. ether (colchicine is only slightly soluble in ether, salicylic acid 1 in 2). The separated ether layer was washed twice with 10 cc. of water and evaporated. The residue consisted entirely of salicylic acid. (2)

0.2 gm. was dissolved in 15 cc. water and shaken with 10 cc. chloroform. The free salicylic acid, precipitated in the water layer. The separated chloroform was washed twice with 30 cc. water and evaporated to dryness. The residue consisted entirely of colchicine and gave no purple with $FeCl_3$.

Colchicine Tannate.—This is the only stable salt, and is prepared by adding tannic acid solution to a solution of colchicine. Care must be taken not to add excess of tannic acid, as this precipitate dissolves in excess. It is a grayish, amorphous powder, insoluble in water, but soluble in weak solutions of alcohol and in hot water.

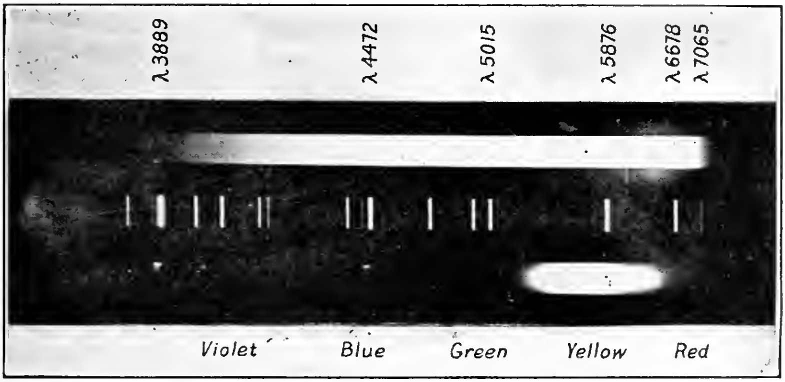
SCIENTIFIC AND TECHNICAL ABSTRACTS

COLD LIGHT.

All our artificial methods of illumination are dependent in the last analysis upon the combustion of hydrogen and carbon, except where water-power is the source of the energy. In ordinary practice the percentage of energy manifested as light is small, the bulk of the radiation being heat. A cold light is a very desirable product, for not only will economy result, but in certain applications, as in lantern projection and photomicrography the heat of the powerful lamps that are needed is a very serious objection. Sources of light low in heat rays are not unknown, but as yet no practical use has been made of them, and only limited studies as to their power and nature. Among the most common forms of such light are the emissions by living organisms and phosphorescence of mineral substances. The glowworm and firefly are familiar examples of the former, and the light emitted by phosphorus is a well-known instance of the latter. The "fox-fire" often seen on rotting wood is doubtless largely, if not entirely, due to minute organisms. We have also the glow of radioactive substances as seen on the dial of watches, which is, however, too feeble to serve as a radiant illumination.

The glow of phosphorus is due to oxidation, but it is remarkable that it is prevented by small amounts of substances which seem to have no specific chemical relation to the element. Lord Rayleigh has

lately published some researches on the subject. Camphor, ammonia and pear oil are among the most active restrainers of the glow yet found. Some hydrocarbons are also effective. Water vapor promotes the action up to a certain amount, beyond which it interferes. Moderate drying of the air in which the phosphorus is exposed produces a steady glow. Rayleigh's investigations show that the action is not by a wave of oxidation passing from one point to another in the vapor as has been supposed, but that the action is more recondite, being due to the formation of nuclei somewhat similar to the effect of a small crystal of a substance propagating crystallization in a supersaturated solution of the same substance. The inhibiting substances are supposed to be capable of associating their molecules with the nuclei and thus preventing the propagation.



Spectrogram of fire-fly light (lower spectrum), carbon incandescent electric lamp light (upper spectrum), helium vacuum tube (middle spectrum).
—*Courtesy of The Franklin Institute.*

Rayleigh's studies did not include an examination of the spectrum of the glow, but an interesting study of the light of the glowworm and firefly has been made by Dr. Herbert E. Ives, and recently published in the *Journal of The Franklin Institute.* These animal glows are, without doubt, due to chemical action, presumably oxidation. They often seem feeble, but this is on account of the small area in action. Ives made quantitative determinations of the light of common luminous insects and also a spectroscopic study. The following is an account of the more important results obtained by him.

The measurements were in "lumens per square centimeter," a datum that is purely physical and need not be discussed here. He describes his methods in detail. The large Jamaica firefly gives out a light which was estimated by Pickering to be 0.004 candle. This is a flash, not a steady emission. The larva of the firefly has a steady glow which is sensibly equal to the flashes of the insect. Compared with a tungsten filament or the typical sky, the light from these glowing masses appears small. This does not prove that it is too small for use. To determine whether the light is or not applicable as an illuminant it is necessary to make quantitative tests. Dr. Ives finds as a result of extended experimenting under very ingeniously arranged apparatus that while the light of the glowworm is not capable of use in locomotive headlights or for intense local lighting, it is, as it stands, of an intensity sufficient for use in comparison with some methods of lighting now in vogue.

A study of the intensity and amount of light emitted, and comparison of this with common sources of light, is only part of the investigation. The composition of the light is important. This can only be determined by the spectroscope. Owing to the fact that the human eye has only a range of percepion from violet to red, while light rays are frequently emitted beyond both these limits, photography must be employed for a complete study of the spectrum of any source. Panchromatic plates having a range well above the violet are easily made and these were employed in the investigation. To obtain a full record of the ultra-violet light quartz lenses and prisms must be used. By placing a flashing firefly before the slit of a small quartz spectroscope, a photograph of the spectrum was obtained which shows that the light (practically yellowish green) is limited to a narrow area in the visible spectrum. There is no evidence that any rays beyond human vision are emitted, but the light is just that which gives the highest sharpness in discerning detail, in which respect it surpasses any artificial light now available. Being, however, limited in range of color and lacking blue, green and red, it would give a somewhat ghastly tint to all objects, like the illumination produced by burning an alcoholic solution of salt. It is essentially a "cold" light, for while in our ordinary illuminants light is a by-product of heat dissipation, in the firefly heat is a by-product of light production.

H. L.

The Yield of Glucose From Cotton Cellulose.—Irvine and Hirst (*J. C. S.*, 1922, vols. 121-2, 1885) made an investigation with a view of determining the reason that the usual processes for converting cellulose into glucose do not give the yield that would be expected upon the theory that cellulose is composed entirely of glucose units. Previous investigations by Irving and Soutar in 1920 had given a yield of 85%. The experiments now reported were carried on upon the same general principles as the former ones, but a notable improvement was obtained by conducting the acetolysis in the manner suggested by Barnett (*J. S. C. I.*, 1921, v. 40). An excellent yield of cellulose triacetate of uniform quality was obtained, and as no sugar was found in the washings, much work was eliminated. The conversion of the acetate into methylglucoside was performed in many ways, but for quantitative work of this kind, the best results were obtained by digesting small amounts of the compound with methyl alcohol containing about 0.75% hydrogen chloride. The use of an autoclave was abandoned, the whole procedure being carried out in sealed tubes, containing about 4 grams of the triacetate. After about seventy hours' action only a trace of solid matter remained, and the solution, which was faintly yellow, contained alpha- and betamethylglucosides in equilibrium. The specific rotation of the liquid ranged within 107-108°, the calculation being based on the assumption that the whole of the cellulose has been converted into the methylglucoside.

Each of the reactions involved has been carried out on numerous occasions and by independent workers. With practice and experience the yields have been regular, and the following figures are submitted as the average of concordant experiments.

Cotton cellulose	100	parts
Cellulose triacetate	117	"
Methylglucosides	114.1	"
Equivalent of glucose	106	"

The yields are in each case about 99.5% of the theoretical.

H. L.

Manufacture of Carbon Disulphide in the Electric Furnace.—George A. Richter, of the Research Department of Brown and Company, Berlin, N. H., contributed to the forty-second general meeting of the American Electrochemical Society a paper embodying

the results of experiments on the production of carbon disulphide by the Taylor process, although differing somewhat from the original form of that process. Large-scale production is based upon the direct action of the two elements at a temperature ranging from 600° to 1000° C., at which temperatures the sulphur is, of course, in the form of vapor and the carbon an incandescent solid. Not all forms of carbon are admissible; anthracite, gas coke and other dense forms cannot be used. Good grades of willow or birch charcoal are among the best, especially those with a low ash content. The materials should be as dry as practicable. Water vapor will form hydrogen sulphide and other sulphur compounds. The charcoal should be well burned. The mechanical arrangements are described in the article, and the thermal data are presented in much detail. The conclusions are that a comparatively recent process for the manufacture of carbon disulphide has been devised and actual plant data indicate that the units operate with reasonably fair thermal efficiency.

H. L.

Manufacture of Vanillin by Electrolysis.—In 1895, a German patent was issued for a process for producing vanillin by subjecting isoeugenol to an electric current, the vanillin being formed by oxidation and appearing at the anode. The process was described in some detail, consisting essentially in placing in the anode cell a 15% solution of isoeugenol in an excess of sodium hydroxide, the cathode cell being charged with a 15% solution of sodium hydroxide. A current of about 5 volts and 6 amperes was recommended. The course of the action is followed from time to time by withdrawing small portions and testing for vanillin. A temperature of about 60° C. is advisable. When the action has progressed well, the anode liquid is shaken with ether which dissolves the vanillin and any unchanged isoeugenol. The vanillin is recovered by shaking with acid sulphite, and this compound decomposed in the usual way.

Notwithstanding the specific claims of this patent, Alexander Lowy and Catherine M. Moore, of the Department of Chemistry, University of Pittsburgh, found by careful experiments that the results stated cannot be obtained. Their work was communicated at the forty-second general meeting of the American Electrochemical Society in September last. All attempts to get an appreciable yield of

vanillin failed. Vanillin, itself, was found to oxidize readily, and even if produced in the process will be at once converted into other substances. Experiments were also carried out in which sulphuric acid was used as the electrolyte, but also failed. In all the experiments a resinous substance was obtained. Statements are made in textbooks that vanillin can be obtained electrolytically from isoeugenol, but such statements are not borne out by the investigation. If isoeugenol can be so converted, it must be under conditions different from those called for in the patent.

H. L.

Preparation of Perchlorates by Heating Chlorates.—Mathers and Jones, respectively of the Indiana State University and the Research Department of the Roessler and Hassler Chemical Company, St. Albans, Vermont, have investigated the comparative yields of the electrolytic and direct heating processes for obtaining perchlorates. They failed to find any method by which the yield in the heating process can be increased over that heretofore obtained. Additions of different substances were made in hopes to establish a catalytic effect, but none served the purpose, and most decreased the yield. The maximum yield was obtained by heating from 1 to 50 grams of potassium chlorate at from 480° to 560°C. for from 30 to 60 minutes. The yield was about 55%. Sodium chlorate gave lower results, and several other chlorates were largely decomposed to chloride. The use of perchloric acid for electrolytic purposes makes its production important.

H. L.

ABSTRACTS OF CERTAIN PAPERS PRESENTED IN THE SCIENTIFIC SECTION OF THE AMERICAN PHARMACEUTICAL ASSOCIATION.

The Occurrence and Forms of Calcium Oxalate in Official Crude Drugs. Edgar T. Wherry and George L. Keenan, Bureau of Chemistry.—About seventy-five of the drugs listed in the U. S. Pharmacopœia, ninth revision, and the National Formulary, fourth edition, are stated to contain crystals of calcium oxalate. A study of these crystals by the immersion method under the petro-

graphic microscope has shown that the larger part of the crystalline material heretofore described as being calcium oxalate has been confirmed as such, while in a few instances, *e. g.*, the leaves of Belladonna and Hyoscyamus, the crystalline material has been found to be a substance other than calcium oxalate monohydrate. With the aid of this method, the identification of crystalline material as calcium oxalate monohydrate in powdered drugs should be readily accomplishable.

Some Interesting Medicinal Plants of Bolivia.—The total number of plants possessing medical interest collected on the Mulford Biological Exploration of 1921-1922 was large. Many of the specimens are wanting in flowers or fruit, or both, and their identification will be difficult and slow. The present paper deals with but three groups:

1. Coto Bark and its Substitutes.
2. Cocillana Bark and its Substitutes and Congenors.
3. Vilca Bark.
4. Bystropogon as a Source of Volatile Oil.

In the case of numbers 1 and 2 the object is to indicate the distinctions among the members of each group, and the methods of identification, not only of the crude drugs, but of their galenical preparations. No. 3 is believed to be unknown to science and is here described. No. 4 discusses only the identity and distribution of one of the species, the oil of which has been subjected to investigation.

In this paper, taxonomic and general facts are discussed. The histology and chemistry of the drugs will be discussed by my colleagues.

H. H. Rusby.

On the Chemistry of the Seeds of Datura Stramonium. By Isao Nishimura and Edward Kremers. Abstract.—The breeding of *Datura stramonium* for alkaloid is an important problem in the cultivation of medicinal plants, but it is only one of numerous problems associated with the economic aspects of the culture of this plant. Some of these problems have been alluded to at previous meetings. Suffice it here to point out that the seeds, which constitute an

important percentage of the crop, possess an economic value as well as scientific interest. Whereas the endosperm contains fatty oil—that of the immature as well as that of the mature seeds was examined—the seed coating contains not only a relatively high percentage of alkaloid, but a strikingly fluorescent principal as well. The alkaloidal content of the germinated seeds was also ascertained.

Diethylphthalate. By J. A. Handy and L. F. Hoyt. Abstract.—A brief historical review of the literature, together with a discussion of the practical use of Diethylphthalate as a modifying agent for specially denatured alcohol approved for use in the manufacture of high grade perfumes and toilet waters.

The physical and chemical constants of six standard American brands and two foreign brands are given, together with the technique involved in their chemical assay.

The following data shows the range of variation for all the different samples:

Specific Gravity /15.6° C. .... 1.1218 to 1.1261
Refractive Index /20 .... 1.5008 to 1.5020
Optical Activity /20 .... (—) 6°, 26.4′ to (+) 0°, 6.2′
Free Acidity as Phthalic Acid .... .017 to .105 per cent.

Saponification (mgm.KOH per gm.) 500.82 — 504.16 = 99.16 to 99.82 per cent. Ester.

Saponification No. (Corrected for free acidity) 99.09 to 99.78 per cent. Ester.

Boiling Point (29.33″ Barometric reading), 295° C. (average temp.).

A preliminary report will be made on some data for vapor pressure curves for pure Diethylphthalate as well as mixtures of two and one-half, and one per cent. solutions of Diethylphthalate in alcohol.

Deterioration of the Tincture of Digitalis. Charles C. Haskell, D. S. Daniel, and G. S. Terry. Abstract.—When the preparations are assayed by the frog or guinea-pig method, there appears to be a definite loss in the activity of tinctures of digitalis within comparatively short periods of time.

No evidence has been published to justify the opinion that tinctures of digitalis shows any loss of strength in reasonable lengths of time when the tests are carried out on cats; rather, it would seem that the tincture, as judged by this method, is practically stable.

The experiments presented in this paper support the view that the majority of samples of tincture made with 70% alcohol undergo little or no change during five years.

The explanation for the different results obtained by the frog and guinea-pig method on one hand and the cat method on the other in all probability lies in the fact that with the lapse of time a change takes place in the tincture which renders the preparation more difficult of absorption from the lymph sac of the frog, but, apparently does not render it more difficult of absorption from the alimentary tract of the cat.

The Quantitative Determination of Sparteine in Tablets. By Paul W. Jewel. Abstract.—The investigation was carried out with a view to developing a method for the quantitative determination of Sparteine, which would be rapid and simple and which could be depended upon to give accurate results.

Sparteine is only slightly volatile at 100° C., the loss being only 3.1% after an hour's heating at this temperature, 1.0% more after half an hour, and at the end of seven nours' continual heat 2.5% additional. The use of a small amount of heat does not affect the accuracy of the gravimetric determination, and the alkaloid is not lost through volatilization in the vapors of chloroform. This is further substantiated by the fact that the quantitative determination of pure Sparteine Sulphate showed a recovery of 99.3-99.5%.

The U. S. P. and Jorrisen qualitative tests are very distinctive and considered to be preferable to that of E. H. Grant.

Sparteine Sulphate U. S. P. is monoacidic to methyl red and to phenolpthalein and may be titrated direct with N/50 sodium hydroxide, using these indicators, phenolpthalein being preferable to methyl red.

MEDICAL AND PHARMACEUTICAL NOTES

Some Notes Upon the Hair.—M. Sabourand, the eminent dermatologist, has pointed out the harmfulness of washing the hair with more or less concentrated solutions of alkaline bases (potassium, sodium, ammonium). This practice renders the hair, so treated, fragile; the ends become forked, ravelled and broken. Heating and curling produce disastrous effects upon the hair, the curling called "permanent" being particularly harmful. Bleaching with hydrogen peroxide is evil; the chemical and physiological action of this product deprives the hair of its elasticity. In the same manner he deprecates dyeing in general as injurious.

To cleanse the hair a very hot solution of borax followed with a hot decoction of soap bark is recommended. This treatment does not injure the hair, although it removes the fatty substances secreted to place a control upon narcotic exports.—(*Repertoire de Pharmacie.*)

W. H. G.

Cocaine Traffic in France.—A modification of the law governing the sale of narcotics is urged, the main points of which are as follows: Forbidding of residence in the country for at least five years for traffickers under pain of an imprisonment of from five to ten years; no legal delays permitted; fines greatly increased; the seizure and closing of shops or places where violations are conducted; closer surveillance at all frontiers and in the country; the creation of an international commission on narcotics; the authority to search premises of traffickers or addicts at any time, when the need is established.

It is thought that the place to combat the evil most successfully is at the source of supply, it being alleged that nearly all the cocaine is produced by two or three works in Germany, no obstacle being placed upon the exportation.

There is hope that the French Government can compel Germany to place a control upon narcotic exports.—(*Repertoire de Pharmacie*).

W. H. G.

ESTIMATING URINARY CHLORIDES.—M. Meillère states that he employs a modification of Mohr's method, consisting of pouring the urine into a solution of silver nitrate—instead of pouring the silver nitrate solution into the urine. One can operate with a simple tube of 20 to 25 cm. in length, of a capacity of 20 to 25 cc. of liquid, divided into cc. and tenths of cc.

He introduces into this tube 10 cc. of a solution containing 29 gm. 09 of silver nitrate per litre, of which 1 cc. corresponds to 1 c. gm. of sodium chloride; then is added one drop of a saturated solution of potassium bichromate, producing the brick-red color of silver chromate. The urine is now poured very carefully in a measured quantity, shaking the tube and keeping it well closed until the color disappears—at the moment of discoloration, the quantity of urine added will contain 10 c. gm. of chlorides.

Let n be the quantity of urine poured into the tube—one litre of urine will contain a quantity of chlorides equal to $100/n$.—(From *Tribune Medicale,* through *Repertoire de Pharmacie.*)

W. H. G.

NEWS ITEMS AND PERSONAL NOTES

HANBURY MEDAL AWARD.—We learn with pleasure that the Hanbury Gold Medal, created to commemorate the work of this illustrious English naturalist, has recently been awarded to M. Perrot, Professor of Materia Medica in the faculty of the Paris School of Pharmacy.

No one is better qualified nor fills more perfectly the conditions of the founders of the Hanbury Medal than Professor Perrot, whose labors are known to scientists throughout the world.

M. RICHARD APPOINTED PROFESSOR.—M. Richard has been appointed Professor of Pharmacology on the Faculté de Medicine de Paris, succeeding M. Pouchet, retired.

The Botanical Society of Pennsylvania.—On Saturday, September 23, the Botanical Society of Pennsylvania visited the Botanical Gardens of the Philadelphia College of Pharmacy and Science near Glenolden, Pa. The party, numbering thirty-five, was under the leadership of Professor Youngken, of the college, who exhibited about 300 species of medicinal and ornamental plants now thriving in the gardens. Intense interest was shown by the party and particularly toward such rarely found specimens in Pennsylvania as the Leprosy plant (*Taraktogenos kurzii*), the Saw Palmetto (*Sabal serrulata*), *Atropa physalloides* and the Cotton Plant (*Gossypium Barbadense*).

Fluckiger Medal Awarded to the American, Dr. F. W. Power.—The Flückiger Medal has to date been awarded to one Englishman (Holmes), one German (E. Schmidt), one Frenchman (Heckel), one German residing in Switzeriand (Hartwich), and two Austrians (Vogl and Mœller). The Swiss Apothecary Association, whose turn it is this year to make the award, has, by direction of the curatorium of the Flückiger Foundation awarded the medal to an American, Dr. Frederick Power.

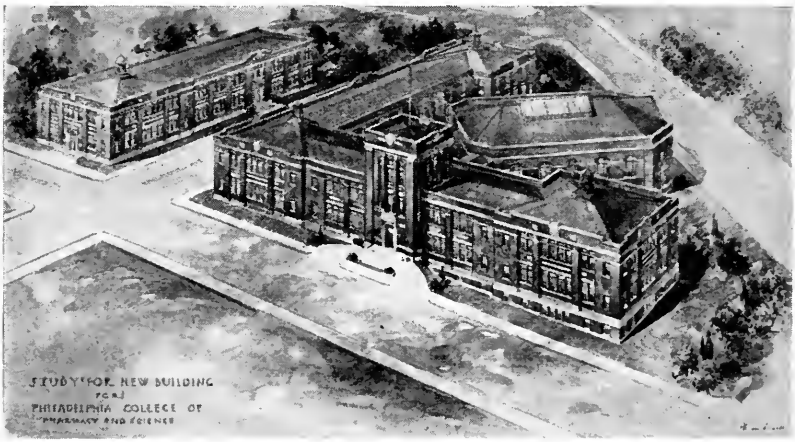
Frederick Power, who at the present time directs the biochemical division of the Bureau of Chemistry of the Department of Agriculture of the United States, which is devoted to the scientific study of plant constituents, was prior to his return to America, his native country, director of the scientific laboratory of Burroughs-Wellcome. in London. During his first residence in America he published many articles, most of which were on essential oils. These earned for him the offer to become chief of the Wellcome laboratories, where, provided with abundant material and aided by numerous assistants, he conducted a large number of valuable investigations of medicinal plants, all of which are characterized by their thoroughness. He succeeded in isolating and identifying a number of new and interesting substances.

Power is one of Flückiger's scholars and for a time was his assistant. About thirty years ago he translated into English Flückiger's *Grundlagen die Pharmakognosie* (Fundamentals of Pharmacognosy).

PHILADELPHIA COLLEGE OF PHARMACY AND SCIENCE NEWS NOTES

Record Attendance.—Over 700 students are registered in the College when it opened Monday, September 25, 1922. More than one hundred applicants for the First Year Class could not be admitted because of limited accommodations.

Quarterly Meeting of College Members.—The quarterly meeting of the members of the College was held on Monday, September 25, 1922. The "College" is an incorporated body which has conducted



Study for New Building for the Philadelphia College of Pharmacy and Science.

the teaching institution for more than one hundred years (since 1821) and published a scientific journal (*The American Journal of Pharmacy*), now of international reputation since 1826.

History of the First Century.—An advanced copy of the Centennial History of the College was shown at the meeting by the editor, Joseph W. England. This volume has been in preparation for about two years, as a feature of the Centennial celebrations and the editor has been assisted by Dr. Ellis Paxon Oberholtzer, Dean LaWall, Dean Stermer and others. There will be over 500 pages of history,

200 illustrations, and, in Part II, more than 9000 biographies of graduates of the College and Medico-Chi, which is now affiliated. This book has already had a large advanced sale.

New Site and Buildings.—President William C. Braisted made the gratifying announcement that the committee appointed by the Board of Trustees last May to work out a program for expansion and development had held many conferences during the summer and made their report at the September Board meeting. Their program received the unanimous endorsement of the Board, and the completion of the first step was already an assured fact.

This planning committee consisted of:

Samuel P. Wetherill, Jr., Chairman
Russell T. Blackwood
William C. Braisted, M. D.
Otto W. Osterlund
Frank R. Rohrman
William L. Cliffe
Milton Campbell
Charles H. LaWall
Benjamin T. Fairchild
George D. Rosengarten, Ph. D.
George B. Evans
Horatio N. Fraser
E. Fullerton Cook, Secretary

The complete program embraces four objectives:

I. Larger and more suitable location.
II. Modern, newly equipped and commodious buildings.
III. An Expansion Trust Fund.
IV. Therapeutic Research Laboratories.

On October 2, the College officials took over the title to the property at Forty-third and Woodland Avenue for the site of the new College buildings. The price was $60,000 and the lot has been secured through the generosity and assistance of the President, the officers, the Trustees and Faculty.

The campaign for funds for the buildings and expansion will be immediately launched under the direction of the President and the committee of the College.

The Therapeutic Research Institute which will co-operate with the medical colleges of Philadelphia and established hospitals, is an important part of the College program for its second century.

Admiral Braisted, Surgeon-General of the United States Navy throughout the World War, has devoted much time during the last two years towards the establishment of the Gorgas Memorial in Panama, an institute for the study of tropical diseases, to commemorate the monumental services of General Gorgas.

Dr. Braisted has now moved to Haverford, a Philadelphia suburb, and will actively promote the expansion program of the College and also the Therapeutic Research Institute, which so properly belongs to Philadelphia, with its splendid record for service in the medical sciences.

Campaign Office Opened.—An office has been opened in the College, at 145 North Tenth Street, for the conduct of an active campaign for new buildings and an endowment fund. The gift of the new lot is tangible evidence that those who are locally active in College affairs believe in the expansion program and have confidence in the support of the Alumni and friends of the College.

University of Pennsylvania Co-operation.—Arrangements have been made with the University of Pennsylvania to conduct the selling and advertising classes in the Business Administration course of the College of Pharmacy. These courses will be under the direction of Dr. Hess, a member of the Faculty of the Wharton School.

When the College moves to its new site only three squares from the University, some of the economic policies recently referred to by acting-Provost Penniman, of the University, can be admirably developed. That this is practical and that there exists this friendly relationship between these two older teaching institutions in Philadelphia is evidenced by the arrangements just announced.

Free Public Science Lectures.—The second series of free public lectures, by members of the Faculty of the College has just been announced. These lectures will be held on Wednesdays, at 8.15 P. M., beginning October 11, at 145 North Tenth Street. The subjects are:

"Chemistry as an Aid in the Detection of Crime," Dr Henry Leffmann.

"Corn and Its Products," Prof. Freeman P. Stroup.

"The Story of Glass," Prof. J. W. Sturmer.

"Vitamines," Prof. David Wilbur Horn.

"Bacterial Preparations in Common Use," Prof. Louis Gershenfeld.

"The Aluminum Age," Prof. Ralph R. Foran.

"The Making of Medicines," Prof. E. Fullerton Cook.

"The Cost of Patent Medicine," Dr. Horatio C. Wood.

"The New Alloys of Iron and Their Uses," Prof. Frank X. Moerk.

"Another Drop of Blood," Prof. Ivor Griffith.

"The Romance of Spices," Prof. Charles H. LaWall.

"Catalysis and Catalysts," Prof. Samuel P. Sadtler.

"Animal-Eating Plants," Prof. Heber W. Youngken.

"Explosives and Explosions," Dr. Henry Leffmann.

At the close of the series the lectures of this year will be published in book form.

Citizenship.—Recognizing the importance of stimulating the sense of loyalty and obligation as citizens, five lectures were given during last year's course on the subject of citizenship all students being admitted. This year, because of the greatest interest and benefit, the number of these lectures will be doubled and the speakers will be prominent publicists of Philadelphia and New York, men of inspirational power.

The following members of the faculty were in attendance at the meetings of the Pennslyvania Pharmaceutical Association at Buena Vista Springs, Pa.: C. H. LaWall, H. W. Youngken, F. P. Stroup, L. F. Cook, R. R. Foran, R. P. Fischelis, Paul S. Pittenger, E. J. Hughes and A. B. Nichols.

Those attending the meetings of the American Pharmaceutical Association at Cleveland, Ohio, were: Charles H. LaWall, H. W. Youngken, E. F. Cook, J. W. Sturmer, F. P. Stroup, Ivor Griffith, Paul S. Pittenger, R. P. Fischelis, Dr. F. E. Stewart, A. B. Nichols and Dr. Braisted.

The annual convention of the Beta Phi Sigma Fraternity was held August 21 and 22 at Buffalo, N. Y., at The Stuyvesant. About thirty-five delegates from the various chapters were present and the following officers were elected: Dr. Heber W. Youngken, Grand Councillor; Dr. Charles H. Abbott, of Buffalo, Vice Grand Councillor; Dr. Henry G. Bentz, of Buffalo, Grand Secretary, and John L.

Repton, of LeRoy, N. Y., Grand Treasurer. Applications for three new charters were passed upon.

Members of the Phi Delta Chi Fraternity attending the meetings of the American Pharmaceutical Association at Cleveland, Ohio, celebrated the occasion by having a dinner at which about thirty-five were present. Instructor Adley B. Nichols is Grand Vice-President of the national organization.

CORRESPONDENCE

American Journal of Pharmacy,
Philadelphia, Pa.

Gentlemen:

I beg to submit the following formulas for non-alcoholic elixirs, or more properly termed solutions, which are intended to replace the present alcoholic solutions dispensed under these names.

The definition of an elixir carries with it the understanding that such a preparation contains but small amounts of medicinal substances incorporated with alcohol, syrup, water and aromatics. The introduction of the Volstead Act makes it desirable, where possible, to dispense with the use of alcohol.

I believe there are many official preparations which now contain alcohol, but which would be better without this solvent, not only from an economical viewpoint, but also from a scientific viewpoint.

These formulas are submitted to demonstrate the possibilities of making non-alcoholic elixirs.

Elixir Lactated Pepsin.

(Equivalent of 40 grams of lactated pepsin to the fluidounce.)

Granular pepsin 1-3000	5 oz. 372 gr. (Avoir.)
Sugar	10 lbs.
Benzoate of soda	1 oz.
Lactic acid	8 fl. oz.
Glycerin	1 gal.
Flavoring mixture	2½ fl. dr.
Carmosine (water soluble aniline)	1 dr.
Water, to make	5 gals.

Elixir lactated pepsin, 80 grains to the fluidounce may be made with double the amount of pepsin.

Flavoring Mixture.

Oil Orange (Terpeneless)	1 fl. oz.
Oil Lemon (Terpeneless)	2 fl. oz.
Oil Nutmeg	1 fl. dr.
Oil Aniseed	2 fl. dr.
Oil Lemon grass	2 fl. dr.
Citral	3 fl. dr.

Rub 2½ fluid drams of oils thoroughly with the talcum and then add the dram of carmosine, then the benzoate of soda, add this mixture to 10 pounds of sugar in a 5-gallon receptacle and stir it thoroughly. Next add the lactic acid, pepsin and water, about three gallons, and let stand about twelve hours. To four 1-gallon well-wetted filters add a little powdered talcum and filter up to four gallons, then add the glycerine to completion.

Elixir of Iron, Quinine and Strychnine.

Iron and Quinine Citrate (Scale Salt)	10 oz. (Avoir.)
Sugar	10 lbs. (Avoir.)
Strychnine Sulphate	80 grs.
Sodium Benzoate	1 oz. (Avoir.)
Talcum	2 oz.
Flavoring mixture	2½ fl. dr.
Glycerin	1 gal.
Water, to make	5 gals.

In a wedgewood mortar rub the flavoring mixture with the talcum and benzoate of soda and about two quarts of water. Add this mixture to the sugar in a five-gallon container, then add the scale salt and stir all thoroughly. Dissolve the strychnine sulphate in about one quart of hot water and add this and enough water to make about four gallons; when all dissolved pour into into four or five one-gallon well-wetted filters which have added a little talcum in the bottom of the filter, and when four gallons are obtained add the glycerine for completion.

Respectfully yours,

Geo. H. Copeland, Ph. G., Class 1888.

(Editorial Comment: The above formulas may be perfectly practicable and productive of elegant galenicals, but we doubt very much the advantage of substituting sodium benzoate for the alcohol,

which is now used as the preserving agent. In the first place, benzoate of soda is illegally used unless the label carries the legend of its presence in the bottle, and we have also been taught that benzoate of soda, in common with all other chemicals of its type, inhibits the peptic activity of the digestive ferment. It is also to be noted emphatically that the second formula is entirely at variance with the official product, and that the first formula differs markedly from the former N. F. digestive elixir. We doubt very much whether either of these non-alcoholic elixirs bears comparison with the present alcoholic product.)

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION
NEW HAVEN, CONN.

October 6, 1922.

Editor, THE AMERICAN JOURNAL OF PHARMACY.

Dear Sir:

May I call your attention to a typographical error in the article by Dr. Leffmann in the September number of your JOURNAL which reviews work on the cryoscopy of milk reported in Bulletin 236 of this Station. On page 585, line 12, it reads "minimum of —0.5930°" whereas it should read "minimum of 0.530°."

As these limits are important, the accidental insertion of a "9" between the 5 and 3 is unfortunate and I judge you or Dr. Leffmann may wish to correct it in your next issue.

Respectfully yours,

E. M. BAILEY.

BOOK REVIEWS

A TEXTBOOK OF ORGANIC CHEMISTRY. By Joseph Scudder Chamberlain, Ph. D., Professor of Organic Chemistry, Massachusetts Agricultural College. 12 mo., pp. 959. Cloth, $4. Philadelphia, P. Blakiston's Son & Co.

The growth of chemical industries in the United States during the last few years, especially during the world's war, has created new interest in chemistry. This is especially true as to organic chemistry. In the book before us the author presents the subject in a sufficiently

elementary manner so as not to go beyond the grasp of the student in his first course in organic chemistry, and at the same time makes the text comprehensive in that it covers the entire field by taking up practically all the important groups of compounds.

We beg to call special attention to the classic arrangement of the text from which we will cite the following headings:

Part I. A—Cyclic Compounds: a, Simpler Saturated Compounds (Hydrocarbons of Saturated Series; Mono-substitution Products of Saturated Hydrocarbons; Oxidation Products of Alcohols); b, Simpler Unsaturated Compounds (Unsaturated Hydrocarbons; Mono-substitution Products); c, Poly-saturated Products (Poly-Halides, Cyanides and Amines; Poly-Hydroxy Compounds; Mixed Poly-substitution Products, Poly-Aldehydes, etc.; Carbohydrates, Amino, Acids and Proteins; Cyanogen, etc.; Carbonic Acid, Urea, Purine, etc.).

Part II. Cyclic Compounds: Sect. I. Carbo-cyclic Compounds: a, Alicyclic Compounds (Saturated and Unsaturated); b, Carbo-Cyclic Compounds (Benzene Series: Diphmyl and Related Compounds; Condensed Ring Compounds; Hydrogenated Benzene Compounds). Sect. II.: Hetero-Cyclic Compounds: a, Five-membered Rings; b, Six-membered Rings; c, Condensed Hetero-cyclic Compounds; d, Alkaloids. The contents alone occupy forty pages.

Besides all this the author furnishes twenty excellent tables, those on essential oils giving source and chief constituents. An excellent list of reference books is found at the end of the volume, besides an appendix containing a brief discussion of the separation, purification, identification, analysis and determination of molecular weight of organic compounds.

Chamberlain's Organic Chemistry is a valuable work which is also very useful to the pharmacy student as a textbook and to the pharmacist as a reference work.

OTTO RAUBENHEIMER, Ph. M.

CHEMISTRY AND ITS USES. By William McPherson and William Henderson, Professors of Chemistry at Ohio State University. 12 mo., pp. 447. Cloth, $1.60. Ginn & Co., Boston.

Both teachers and students have learned that the names McPherson and Henderson are good news on a title page. The authors

of "A First Course in Chemistry" have just published a new text entitled "Chemistry and Its Uses." Every teacher of chemistry realizes that the watchword of the present day is the practical rather than the theoretical, the application rather than the abstract principle, the pictorial rather than the descriptive. Just how far this tendency should be followed each author and each teacher must decide for himself. The volume before us represents the opinion of the present authors.

The book begins with the usual chapters on oxygen and hydrogen and gradually works its way up to organic chemistry. The 260 illustrations, including many short biographies of the pioneers and authorities in chemistry, help to arouse more interest in the study and elucidate the text. The book abounds in the practical applications of chemistry to the arts, industry and every-day life without sacrifice of the necessary basis of theory. The book is stimulating and instructive and is also well adapted for pharmacy students.

Otto Raubenheimer, Ph. M.

Vitamins and the Choice of Food. By Violet G. Plimmer, Associate of the Royal Sanitary Institute, and R. H. A. Plimmer, D. Sc., Professor of Chemistry, the University of London at St. Thomas's Hospital Medical School, etc. Royal Octavo, pp. 168. Cloth, $2.50. Longmans, Green & Co., London, New York, Bombay, Calcutta and Madras. 1922.

Recent scientific work has brought to light the indispensability of vitamins in nutrition. Their absence from the food is the cause of certain definite diseases, such as beri-beri, scurvy, rickets, pellagra, etc., to each of which the book devotes a separate chapter. Common errors in the diet may lead to an insufficiency of vitamins in the diet and the consequent ill-health.

The subject of accessory food-factors or vitamins has a special significance, as it marks the entry of biochemical research into the problems of health and growth. As yet chemical formulæ play no part. While the chemical nature of vitamins is unknown it is proven that some foods contain and other do not contain vitamins, and that faults in the diet are the cause of a number of diseases. The reviewer wants to call special attention to the appendix which contains

a table of six pages showing the distribution of vitamins in foods, which is taken from Report 38 of the Medical Research Committee.

We can heartily recommend this book to pharmacists as it is to their own interest to keep posted on this subject, so as to be able to answer daily questions about vitamins.

OTTO RAUBENHEIMER, Ph. M.

VAN NOSTRAND'S CHEMICAL ANNUAL. A Hand-Book of Useful Data for Chemists and Students. Edited by John C. Olsen, A. M., Ph. D., Professor of Chemical Engineering, Polytechnic Institute, Brooklyn. Fifth Issue, 1921, thoroughly revised and enlarged. Pp. 900. Flexibly bound, 5 x 7½ inches. $4. D. Van Nostrand Company, New York City.

The amount of chemical literature published each year has steadily increased at a very rapid rate. It has become more and more difficult for the busy chemist to gather from this mass of literature the facts which are of interest and use to him. The publication of the Chemical Annual was undertaken as an attempt to overcome this difficulty, at least in part. Professor Olsen, a recognized authority on chemistry, is to be congratulated on this undertaking, which has proven a success.

Recognized as an essential tool that belongs at the elbow of every chemist, this book has already passed through four large edition.

The new 1922 issue is greatly enlarged, thoroughly revised, corrected and carefully indexed for quick reference,—a bigger, better book than before.

One hundred twenty-five complete tables that a chemist constantly uses in his daily work are included in it—the tables of physical and chemical properties of elements and compounds, tables on the calculation of volumetric analysis, on weight equivalents, specific gravity, thermochemistry, stoichiometry, vapor tension, etc., and with each table is a set of directions for its use.

The referee begs to call special attention to the list of the more important books which have been published in America, England, France, Germany and Switzerland since October, 1917. This list

comprises 84 pages and also includes books on pharmacy, pharmaceutical chemistry and history of pharmacy and chemistry.

A new feature of the new Annual is the inclusion of a few pages of cross section paper which will be found very useful for notes, data, etc.

We can fully endorse Van Nostrand's Chemical Annual, as it supplies in convenient form the information which chemists, pharmacists and students use daily, but which cannot be retained in memory.

OTTO RAUBENHEIMER, Ph. M.

TRANSACTIONS OF THE COLLEGE OF PHYSICIANS. Third Series, Vol. XLIII. Philadelphia, 1921.

For many years this volume, a record of the transactions of a unique and conservative society, has regularly come to our office. This volume contains the papers read before the College from January, 1921, to December, 1921, inclusive. A pathetic reminder of the frailty of the thread of life comes to the reader of Mr. Howard Fussell's memoir of James Tyson. Dr. Fussell read the memoir before a meeting of the Fellows early in the year 1921, and paid a pleasant tribute to the memory of that grand old teacher of clinical medicine. When the leaves were dropping to the ground with the coming of the chill days—in the same year—the reader of the memoir himself passed on to the *bourne whence no traveler returneth.*

A variety of medical subjects are well treated and adequately portray the trend of medical progress particularly along the lines of industrial medicine and endocrinology.

Dr. Newbold's excellent lecture on the Voynich Roger Bacon manuscript is printed in full and is agreeable reading to other than students of medicine. An interesting bit of information points to Bacon as antedating the Dutch Draper in his use of the telescope and microscope.

I. G.

A CENTURY OF THE UNITED STATES PHARMACOPŒIA 1820-1920, LIQUOR POTASSII ARSENITIS. By H. A. Langenhan. Part of thesis submitted for the degree of Doctor of Philosophy, University of Wisconsin, 1918. Bulletin of the University of Wisconsin. Serial No. 1153. General Series No. 936.

This thesis of fifty-seven pages is a comprehensive study of an arsenical preparation which has been used continuously in medicine for nearly one hundred and forty years, and which, before its analysis and professional use by Dr. Thomas Fowler, an English apothecary physician of the latter part of the eighteenth century, had originally appeared as a quack remedy entitled "Tasteless Ague or Fever Drops."

Besides the inclusion of a brief history of arsenic therapy, and a thorough study of the chemistry of the hydration of arsenic trioxide, considerable space is given to the pharmaceutical nomenclature of the preparation, and the varying formulas which have been used since the original letters patent were granted in 1781 to Thomas Wilson, of Snow Hill, London.

The formula of the patentee called for the calcined ashes of common centaury (which furnished potassium carbonate), the "flowers" which were obtained by subliming cobalt (an arsenical pyrites), and Red Saunders, all of which were to be boiled together for four hours, no quantities being stated in the patent.

The completeness with which the subject has been considered makes the monograph a valuable addition to any pharmaceutical library, and it makes interesting reading for any one who is interested in pharmaceutical research.

C. H. L.

ORIGIN AND HISTORY OF ALL THE PHARMACOPŒIAL VEGETABLE DRUGS, CHEMICALS AND PREPARATIONS, WITH BIBLIOGRAPHY. Volume I. Vegetable Drugs. By John Uri Lloyd.

This buckram bound volume was prepared under the auspices of and published by the American Drug Manufacturers' Association, and was printed by the Caxton Press of Cincinnati, Ohio.

The book contains 356 pages devoted to historical miscellany concerning upward of seventy official drugs. Following this is a bibliography of more than 60 pages and an extensive index of both

names and subjects. The subject matter of the book is somewhat disappointing. Instead of containing complete historical monographs concerning the drugs as the title would indicate, the articles concern themselves mainly with the history of the therapeutic uses of the drugs. There is also lacking a definite plan of selection or arrangement of the subject matter.

Another disappointing feature of the book is the incompleteness of its scope. This is not the fault of the author who explains in the preface that he was restricted to the drugs which were official, in the Eighth and Ninth Decennial Revisions of the United States Pharmacopœia. It would have been a great improvement to have made it include all of the vegetable drugs which have been official since the first U. S. P. was issued.

Still another surprise awaits one who uses the book for historical reference purposes when he notes the absence of information relating to the active principles of many of the important drugs.

An historical article on cinchona, for instance, may hardly be considered as complete, which makes no mention of the discovery of the alkaloids and their subsequent replacement of the drug in medical practice, to a large extent. Again, under oil of gaultheria we find no record of the work of Procter or of Cahours in establishing the chemical composition of the oil.

In spite of these evident defects, which are probably due to the critical illness of Doctor Lloyd at an important stage in the preparation of the work, the work contains a large amount of valuable information of its kind, and the style of some of the longer articles is attractive from the literary standpoint.

C. H. L.

THE AMERICAN
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EDITORIAL

PASTEUR THE PIONEER.

Less than half a century ago the aristocracy of medicine foregathered at the Academie de Medicine in Paris to participate in a symposium on puerperal fever. An eloquent fellow of the Academy held the rostrum and delivered a long discourse on the causative factors of this baneful fever, long the grim and merciless ravager of the lying-in hospitals of that city. Empiric and inaccurate were the theories which he expounded, but such indeed was the character of most of the etiologic knowledge of that period.

The speaker, whose name History does not and need not record, after ridiculing those who believed in the germ theories of disease, draws his lecture to a close. Promptly from his seat, which he held as an Associate of the Academy, there arose the genius Pasteur, whose marvellous discoveries in the world of science kept the eyes of the civilized world riveted on France; Pasteur, the son of an humble tanner from Arbois, lifted by the buoyancy of clear genius into that rare realm of pure science, whose boundless domains few humans are

privileged to know; Pasteur, the living contradiction of Pope's famous couplet,

> "One Science only with one genius fit,
> So vast is Art, so narrow human wit."

But not so with Pasteur, for his inspiration led him on from science to science, explaining the old and establishing the new; harnessing chemistry to agriculture and biology to industry. And he was a pioneer, a blazer of new trails. The roads which he chose were the hardest, but they led always to kingdoms that had the things which men sought and longed for, but could not find for themselves.

It was this Pasteur who arose in that august assembly of doctors and surgeons, and who had the temerity to say that the eloquent gentleman erred in stating that puerperal fever was not due to a microbe. In a hotbed of conventionalities and false dogmas, in an Academy proud of its conservatism, Pasteur, not even a physician, thus contradicted with bluntness but with correctness, the foremost practitioners of the day.

To clinch his statements he went to the blackboard and drew on it the rosary of streptococci, which he described as minute round organisms, growing in chains and which he had discovered in the blood clots during infection following childbirth. "There," said Pasteur, "you have its outlines." (*"Tenez, voici sa figure."*) And with the very sound of the words, as it were, came the dawn of a new day. The art of medicine and the science of surgery became possessed of a firmer sense of service and a new responsibility. Out of the world went a heap of sadness, and man's burdens eased upon his weary shoulders. Thus it was that the tanner's boy from Arbois, in France, came to change the whole aspect of medicine and surgery.

Out of the di-symmetry of life France produced in the same age two remarkable men, one the crystal genius, Pasteur, whose beautiful life and works stand unparalleled in the annals of science, saviour of millions of lives; the other, the genius Napoleon, who likewise stands unparalleled but only as a destroyer, and who sent legions of men to an early death. Pasteur whose works will carry on to the end—Napoleon whose influence has long since gone into the darkness.

Today, in the Pasteur Institute, close to the heart of Paris, lies the body of the great benefactor of posterity. It is well that France has remembered. For a world remembers him today, the centenary of his birth, and in Paris—his city—in the vault over his grave, are four great white angels, Faith, Hope, Love and Science, watching silently over their sleeping son.

I. G.

A NEW PERIL FOR PHARMACISTS.

A recent conviction of a pharmacist after a trial by jury in a Pennsylvania Common Pleas Court for violation of the State liquor law brings a new peril into view for pharmacists.

Contrary to the first picture which flashes into the mind of a "bootlegging druggist" taking a chance in connection with the sale of "hootch" without a prescription, this is a case of a conscientious pharmacist who has not even handled potable spirits on prescription, who conducts a professional store with no soda fountain, candy counter or similar side lines and who was penalized for selling a well-known proprietary brand of "bathing alcohol" to several individuals, who used the liquid internally with intoxicating effects.

The defendant admitted the sales in question, but declared that at the time the sales were made he had not known or suspected that it was purchased with the intent to use it as a beverage and as soon as he learned of its possible use in this connection he had stopped its sale and cancelled his orders for future supplies.

The judge in his charge to the jury, after quoting the high percentage of alcohol in the preparation said:

"With that volume of alcohol these goods would be intoxicating, and as we apprehend the law the only question in this case for you to determine is whether this defendant sold to these witnesses the goods testified to by them for beverage purposes. Whether this mixture was or was not ordinarily and in general acceptance fit for use as a beverage, we do not regard as material."

The fine imposed in the case after the jury had returned a verdict of guilty was $750, a very large amount.

Under conditions as above described no pharmacist is safe in selling even a bottle of flavoring extract or perfume unless he obtains an

affidavit from the purchaser setting forth the legitimate purpose for which the article is to be used.

Another and more important phase of the situation is the apparent inadequacy of the denaturing or medication or whatever they choose to call the addition of foreign substances that is required for the numerous alcoholic preparations sold for external use under special Federal permit.

Some of these preparations are unsuited for internal administration, while others either are not or can easily be made potable by a little manipulation. It is evident that the community is full of dipsomaniacs and worse who will drink anything that has a "kick" in it. The ghastly tale of pre-Volstead days of the janitor at a well-known natural history museum who had to be discharged because he drank the alcohol which he removed from the reptile specimens has lately been surpassed by an incident in a Philadelphia hospital where an orderly was detected removing and using for beverage purposes the alcohol in which the cancer specimens had been preserved. Another authentic case is one in which a popular brand of "solidified alcohol" figures. This is said to be prepared for "internal administration" by squeezing it through cheesecloth, which removes the major portion of the sodium stearate and yields a very impure form of denatured alcohol which seems to be tolerated by those who have formed a liking for it. Still another instance is one in which a painter, who had been making repeated purchases of commercial denatured alcohol, and who to prove his legitimate need for it brought in a bottle containing linseed oil with which the alcohol was mixed to ostensibly produce a furniture polish or paint cleaner. He was later detected in the act of drinking several ounces of this unsavory mixture.

Are we developing drinkers who are immune to substances ordinarily considered toxic? Must an alcoholic preparation actually contain poison in order to make its sale for technical or external purposes legal, and in that manner eliminate the foolhardy ones who take a chance, who will make their exit via the River Styx and leave the United States populated with only the law-abiding and careful?

And what of the grocery stores and department stores which have counters filled with these specially denatured alcohols for external use? Bathing in alcohol would seem to be more popular than bathing in water from the volume of business carried on and the way the producers advertise and fight for it.

The whole system of Federal regulations is weakened by such a condition and all of the elaborate rules for ensuring non-potability are thrown into disrepute.

Pharmacists are harassed and beset by enough troubles connected with the use of alcohol in official preparations without rendering it perilous to make occasional retail sales of preparations which have been approved by Federal authorities as non-potable. Truly these are parlous times when one who walks even a straight and narrow path is likely to stumble in the darkness brought about by official incapacity.

C. H. L.

(In connection with the foregoing editorial, the following caustic article from the columns of the Scrantonian, a lay newspaper, furnishes the sympathetic viewpoint of a person outside the ranks of pharmacy. "While the bottlegger, home-brew artist and others may secure the stuff with which to endanger the lives of those inclined to indulge in intoxicants, the honest druggist, who tries to live up to the law, is constantly pestered by arbitrary rulings of revenue officials puffed with brief authority. The rulings of these addle-pated fanatics, coupled with the activity of the sleuths who are apparently anxious to 'get something' on the pharmacist have made the lives of druggists miserable.

"The government sleuths and pin-head commissioners who give 'rulings,' act apparently on the supposition that every drug store in the land is a speak-easy and that no one wants alcohol for any save drinking purposes. Thus while the men who run liquors through the country at night and at other times do not appear to worry these revenue officials very much, the sleuths believe that the druggists should be watched.")

Editor.

ORIGINAL ARTICLES

LOUIS PASTEUR.

By Louis Gershenfeld, Ph. M., B. Sc., P. D.
(Professor of Bacteriology and Hygiene, Philadelphia College of Pharmacy and Science.)

Louis Pasteur is the most striking figure in nineteenth century science. By the force of his intellectual energy he lifted himself to the level of earth's great men. He revolutionized chemistry, physics, biology, medicine and surgery. He opened up the new fields of bacteriology, embalming and sanitation. His work on practical subjects, on fermentation and spontaneous generation, not only represent great advances in science, but they have opened new avenues into the heretofore undiscovered domain of scientific knowledge.

Louis Pasteur was born on December 27, 1822, at Dole, France. His father, Jean Joseph Pasteur, a tanner by trade, served as a non-commissioned officer in the Peninsular War and received the Cross of the Legion of Honor. Louis was the only son of four children. When young, his family moved to Arbois. Pasteur went to the Arbois primary school and later attended the College of Arbois. He was merely an average student showing a marked taste for drawing. Persuaded by the principal of the college to work for a degree, in the fall of 1838 Pasteur went to Paris to attend a boarding school, but was soon compelled to return home because, as he expressed it, of the loneliness in Paris. He again entered the College of Arbois, and during 1839 carried off many prizes. Because the classes here were not far advanced, the following year he went to the Royal College at Besancon. Here he taught physics and mathematics, receiving board, lodging and a small retaining fee and studied during his spare moments. He successfully passed his examination in the studies he pursued at the Royal College, and in 1842 took an examination to gain admittance into the Ecole Normale. Dissatisfied with the low average he received in his entrance examination, he resigned and decided to compete again the following year. During the interim he gave private lessons in mathematics and attended lectures on chemistry by J. B. Dumas, the great chemist. At the end of the year he took his admittance examinations again and was fourth on the

list for the Ecole Normale. Here he proved to be a satisfactory pupil, but did not distinguish himself by any exceptional merit. From 1844 to 1847 he was devoted to the study of chemistry. It was during this time that the topic of the day seemed to be the internal constitution of molecules and the arrangement of atoms in substances, which, though they are composed of exactly the same constituents, exhibit very different physical and chemical qualities. It was in 1844 that he had read of the work of Mitscherlich on the tartrates and paratartrates of soda and ammonia. The essential points in the report as given was that the chemical and physical qualities of the two substances were identical, but their action to polarized light was different. He proved to his satisfaction that the various paratartrates were composed of crystals that were disymmetrical (that is, the image reflected in a mirror could not be super-imposed on the crystal itself). He brought out this idea clearly by referring to the mirrored image of the hand: the image of the right hand as seen in the mirror is the left hand. He found that the paratartrates were disymmetrical, but that they possess two forms of disymmetry. By this discovery he was led to the theory that molecular disymmetry is the result of a certain grouping of the atoms of the molecule and you all are aware that this theory has had considerable weight on the later work on organic chemistry. This discovery not only was to make chemistry and physics, but supported a new science of stereo chemistry and indirectly was a great landmark in biology. In the first five months in the year 1848, four different writings were presented by Pasteur to the Academy of Science on the subject of crystallography. In the same year he was made Professor of Physics at Digon. In the month of January, 1849, he was appointed to the Chair of Chemistry at Strassburg. It is here he met the daughter of the rector of the academy, whom he married during the month of May of the same year. For the next number of years until 1853 he followed up researches in crystallography, and during May of the latter year he succeeded in transforming tartaric acid into paratartaric acid.

He proved that there existed various forms of tartaric acid—all identical from the point of view of their physical and chemical properties, save that they each had their special hemihedral facets and the corresponding rotary power. Such differences were also found by him to exist in all their compounds, each forming distinctive

marks, which were permanent and deep. The first effect was that of gaining for Pasteur the Cross of Chevalier of the Legion of Honor and a prize of 1500 francs awarded by the Pharmaceutical Society of Paris. His growing reputation led to his nomination in the fall of 1854 as Professor and Dean of the newly created Faculty of Science at Lille.

He dwelt more along such lines when he studied mallic acid and asparagin and their compounds.

His next great study was when he began to attempt to explain to his satisfaction a correct reason for fermentation. Lactic acid fermentation first interested him because in many of the industrial fermentations there is produced a secondary product, amyl alcohol, The latter is endowed with rotary power and capable furthermore of forming several crystalline combinations which do not show any hemihedrism. This was the first exception which Pasteur had encountered in this law of correlation between hemihedrism and the rotary power. It is in his writings on Lactic Acid Fermentation, published in 1858, that Pasteur presents the idea that a specific ferment is associated with each fermentation. He shows that there is a disproportion between the weight of the ferment produced and the weight of the matter transformed and he mentions that if two organisms simultaneously invade the same medium, the one which is best adapted to the existing conditions continues to flourish and produce the characteristic end products.

During one of his discourses at Lille he was approached by the father of a student who came to him to explain the difficulty he was encountering in the manufacturing of alcohol from beet. Pasteur determined to study all the phases in the manufacturing of alcohol. He followed out minutely the fermentation of beet juice.

It was during the beginning of all of these studies on fermentation that he accepted the nomination as administrator of the school and sub-director of science studies at the Ecole Normale in Paris. It is here where he arranged for a small laboratory at his own expense and where he followed up his investigations on alcoholic fermentation.

In 1860 he published his memoir on alcoholic fermentation. Here he points out clearly that glycerin and succinic acid are formed in considerable quantities and almost as constantly as the principal products of the fermentation. He states that fermentation is cor-

relative with life, with the organization of globules, not with the death or putrefaction of these globules as was believed. Throughout his entire writing his tone is one which leaves the writer with the thought that the entire question of fermentation is one not of decomposition and death, but of development and life.

After this thorough work on alcoholic fermentation was well under way and resulted in practical observations which proved his theoretical assumptions, he returned to lactic fermentation and started other experiments along these lines. In some of his writings he shows illustrations and describes in detail the separate and distinct ferments which cause lactic acid and alcohol. But a distinct surprise was in store when he experimented and was able to produce a butyric fermentation. Bodies similar to the non-motile alcoholic and lactic ferments (which were considered as vegetables) were not present. The butyric ferment he first called vibrios, and because of their motile nature regarded them as of animal origin. Little did he suspect that this discovery would soon open a new world, the kingdom of the Bacteria. Another important fact that he observed was that the butyric vibrio lives in the absence of oxygen and, in fact, fears its contact, thus the introduction of the idea of anærobic life.

In all his works and writings on fermentation, he presents the problem in such a clear way as to definitely prove that fermentation is a specific phenomenon, due to the existence and development of a particular organism specific for each different type of fermentation.

Now that he had proven that ferments cause fermentation, the question soon was asked, "How do the ferments get in? Are they organized at the expense of dead organic material or are they produced from organisms like themselves?" It is here again that Pasteur steps in and definitely proves to the partisans of spontaneous generation the germ theory. His familiarity with the small organisms, which he showed the world how easily one could manipulate them, definitely and convincingly proved the existence of living organisms in the air and how they in co-operation with the oxygen of the air assisted in the many fermentations. These germs so resistant are indeed widespread. He even determines the temperature necessary for their destruction and points out the necessity of flaming all receptacles used in microbiology—a technique still in vogue today.

It was during his experiments on micro-organisms in the air that he mentions in his communications to the Academy of Science

the use of cotton as a filtering agent to remove bacteria, the advisability of heating milk to 110° C. or 112° C. or one and a half atmospheres to kill all the germs, and if their re-invasion is prevented, no alteration will occur: thus the introduction of steam under pressure or the Autoclave. He makes mention of the existence of germs that produce spores, as the B. Subtilis, and shows that boiling at 100° C. is not sufficient to destroy this organism, but that it must be submitted for a half hour in an autoclave to a temperature of 120° C. He even states that blood, urine and body fluids most liable alteration, if removed with suitable precautions from normal healthy living animals can be kept without alteration, provided that the air in the immediate environment is freed from germs; and finally he clearly demonstrates that the dust in the air contains the germs and that where the air was more dust laden the more numerous the germs. It is in the latter communication that he shows the direction of his thoughts when he says: It is very desirable to carry these researches sufficiently far to prepare the way for a serious inquiry into the origin of disease.

In 1861 the Chemistry Section of the Academy of Science awarded him a prize. In 1862, after his third attempt, he was nominated member of the academy in the section of mineralogy.

Pasteur's studies on fermentation included a thorough consideration of the technique and results obtained in the wine, beer and allied industries. He showed clearly that the so-called diseases in wine, etc., that is bitterness, acid taste, ropiness, were due to the presence of foreign germs, and he set about and showed how to correct these faults. The practical consequences of his discoveries equalled their theoretical promise.

He soon interested himself in the changes in the alcoholic liquids which lead to the formation of vinegar. His experiments and observations which were announced in two communications to the Academy of Science in 1862, and in an article in the scientific annals of the Ecole Normale in 1864, started one of his greatest discussions and conflicts with Liebig, the eminent German chemist.

Pasteur gave conclusive proof that what was necessary was the Mycoderma Aceti. This organism he proves to be singularly prolific, and possesses a marked aerobic character. It was here with the collaboration of Chassang, Professor of Greek, that the two new words were coined: "aerobic," and to characterize the opposite func-

tion as in the vibrio butyricus "anaerobic." This acetic micro-organism takes the oxygen from the air and transmits it to the alcohol for oxidation. It is here that Pasteur points out the possibility of what may be regarded as a diseased condition in so small a creature. If the conditions for proper development are not present, the organism does not convey the proper amount of oxygen and an aldehyde is the result. The latter is practically observed by the product yielding a disagreeable odor. On the contrary, there is also the possibility of the acetic acid being further oxidized into carbonic acid and water. In 1867, at the invitation of the Mayor and the President of the Chamber of Commerce of Orleans, Pasteur went there and taught his method to the manufacturers of their town. He restored security to the Orleans vinegar manufacturers, who could control and regulate the production, and thereafter succeeded in making rapid progress.

Pasteur now reached one of the turning points of his life. For a long time he seemed to connect the theories of fermentation with that of disease and this relationship became still closer when he convincingly proved that living cells controlled the processes of fermentation. It seemed, as was pointed out in many writings by his associates, Pasteur hesitated coming in contact with diseased conditions in the higher animals, because he always claimed he was not a physiologist, though he did attend a course of lectures given by Professor Claude Bernard.

In the early part of 1865 Pasteur was compelled to encounter the problem he hesitated over so long a period, due to the insistence of his close friend, M. Dumas. He was asked to take up the study of the silkworm disease. A mysterious malady was first noted about 1850, which affected the silkworm and was ruining the silk ihdustry of France. Once a colony of silkworms were attacked, complete ruination followed, and it then became necessary for the silk farmer to obtain the eggs of an unaffected race of worms from some other country. Even the latter after a few generations became contaminated. The most careful investigation failed to reveal any method of overcoming successfully this condition. In 1863 the French Government offered to pay a half million francs to an investigator who claimed to have found an efficient remedy for the disease, but even this offer was to no purpose. Hesitatingly Pasteur finally accepted the mission offered to him. Pasteur had only the vaguest idea of

sericulture. He however soon acquired a fragmentary knowledge of the general structure of the larvae of insects by causing the latter to be dissected in his presence and obtained as much information as he could from the latest published works on the subject. In June, 1865, Pasteur set out for the silkworm district of France. His researches lasted for six years. Pasteur showed that the failure of the silkworm was due to two diseases, Pebrine and Flacherie, which were directly communicated to the eggs of the worm. The young from the latter are thus diseased and they by crawling about communicate it to others. To prevent the disease it was necessary to procure absolutely healthy eggs and then prevent their contamination by diseased worms. The eggs of worms which showed signs of infection were to be rejected. Pasteur thus discovered the cause and course of the disease and presented the foregoing simple suggestions as a method of preventing its recurrence. By the introduction of these precautions the silk industry of France was brought back to prosperity.

The six years which he spent in studying the silkworm disease were the hardest days of his life. Fate had dealt him a number of blows which had made his work doubly difficult. He had aready lost his mother and his eldest daughter. At the outset of his work in June, 1865, he was summoned to his dying father and arrived only in time to attend the funeral. In the month of September of the same year he lost his youngest daughter, Camille, who was barely two years old, and in May, 1866, his daughter Cecilie died at the age of twelve and one-half year. Of the five children who had been an inspiration to him, two remained.

On July 1, 1867, he was summoned to Paris, where he received a prize awarded to him for his studies on wine. During this period there were some disturbances that occurred at the Ecole Normale. The school was reorganized. A complete change of faculty took place and Pasteur was compelled to drop out. He, however, was soon appointed Professor of Chemistry at the Sarbonne. In April of 1868 he saw to his great joy the beginning of the building of the laboratory of "chemical physiology," as he termed it. The strain of work and the worry of all the controversies Pasteur had at this time was too great, and in October of 1868 he was seized with apoplexy. He could not speak and his left side was paralyzed. His convalescence was slow but steadily progressive, and it was not until the

early part of 1869 that he was able to get about. He never completely recovered from his illness and was always afterward somewhat lame.

A few days after Pasteur had left Germany in July, 1870, where he stopped to visit Liebig, war was declared. His son aged eighteen soon enlisted and Pasteur with his wife and daughter withdrew to his old home at Arbois. He was so highly incensed at the outrages committed that in January, 1871, he returned to the Dean of the Faculty at Bonn the diploma of Doctor of Medicine, which had been awarded him in 1868 by the university of that town in recognition of his work. During this period he refused an offer by some Italians for a directorship of a laboratory in Milan or a chair of chemistry at Pisa.

From 1871 to 1876 Pasteur did considerable work in improving French brewing. In 1873 he was elected a member of the Academy of Medicine in the section of free associates. He was neither a doctor nor a veterinary surgeon, but many of the members appreciated the importance of his work. At the time he entered Pasteur had more or less fixed ideas about many things pertaining to human pathology because he attempted to apply his own discoveries to them.

Ideas about infection were confused and more or less opposition was constantly being introduced against the attempt of connecting Pasteur's ideas respecting fermentation with that of diseased conditions. About this time Pasteur began to read more and more of the works of men in medicine, surgery and allied sciences. He seemed to be especially interested in the studies which Davaine was pursuing upon anthrax. The Bacillus Anthracis, the causative agent of this disease, was first observed by Rayer and Davaine in the blood of sheep who had died of this disease in the year 1850. Other workers observed these small rods not only in dead animals but also in the blood of living animals suffering from anthrax. It seemed that none of the workers realized that these small rods were the causative agents of anthrax. In 1861 Davaine had read Pasteur's brief communication on butyric fermentation, in which article a rod-shaped organism named a vibrion is mentioned as the specific cause of such fermentation. He immediately set out and proved definitely to the satisfaction of all that this rod which he called a bacteridium was the cause and the sole cause of anthrax. In 1869 Pasteur had described so-called cysts in the vibrion of Flachery, a disease found in silkworms, and he had further demonstrated the increased resistance of

these organisms due to the presence of these cysts. Koch gave an analogous demonstration when he showed the presence of the anthrax spores in 1876. Critics were rising from all sides, and many hesitated to believe the work so far accomplished. It was in 1877 that Pasteur with the collaboration of Jobert made his first experiments on anthrax. Previous observations and experiments had taught him that if he could sow in a suitable medium the blood of the diseased animals taken as it circulates in the veins, he would be able to obtain a pure stock of the anthrax bacilli and keep them for an indefinite time so as to study them more carefully. He succeeded in doing this and used a neutral or slightly alkaline urine as the culture media. It is interesting to point out here as mentioned by Duclau that Pasteur being neither a physician nor a veterinary surgeon, the history of any disease as a disease did not interest him. What he studied was not so much the anthrax disease as the anthrax bacteridium. He had at his command the method of obtaining pure cultures, and thus he had the big secret in being able to study the physiological properties of organisms, to compare them in their pathological reaction and to definitely establish the etiology of a disease.

During 1770 to 1880 he devoted much time to the study of anthrax, even traveling through infected districts. In his conclusions he mentions the many peculiar characteristics of the anthrax bacteridium. He showed that a number of diseases traveling under different names in animals were nothing more than one and the same disease—anthrax. He even demonstrates that the carcasses of animals may aid in the distribution of the disease if they are not buried deeply below the surface of the ground. It is also here that Pasteur introduces the first example of what was to be called bacterio therapy.

During the work on anthrax some observers in inoculating animals with putrid anthrax blood found that death was quickly produced, but all the symptoms were similar to anthrax. Bacteridia were not found in the blood. Davaine answered them and claimed that the disease that they had introduced was not anthrax and pointed out in many ways the difference of the two conditions. His arguments though weighty were not convincing. Pasteur decided to repeat the experiments and set out to study this condition. His investigation immediately revealed a number of important facts. He

clearly showed that the condition which developed was a different disease. The latter was caused by a common bacillus which he calls the vibrion septique. This is known today as the Bacillus of Malignant Edema. He shows that the period of incubation is shorter and death results more quickly. He made haste to study the physiological characteristics of the organisms and immediately pointed out that it was an obligate anaerobe and a marked gas producer. He goes into further detail as to the different characteristics and the different diseased conditions which it causes.

Mention should be made at this time of his celebrated lecture delivered at the Academy of Medicine on April 30, 1878. In his own name and that of his collaborators, Jobert and Chamberland, he elaborated his "germ theory and its application to medicine and surgery." In the suggestions of Pasteur one can constantly foresee the aseptic method. Prevention is better and surely more certain than cure. Without professional experience, but with the conviction of an authorized experimenter Pasteur ventured to make assertions based upon actual observations. Pasteur dwelt more and more into researches which dealt with facts pertaining to human pathology. In 1879 he examined pus from boils and showed the presence of a microbe which he was able to cultivate. The latter appeared microscopically as a mass of rounded granules comparable to irregular bunches of grapes, whence the name staphylococcus which it received. In making these observations Pasteur made frequent visits to the hospitals. He shortly proved this same organism as the cause of osteomyelitis.

At about this time considerable discussion had begun at the Academy of Medicine on Puerperal Septicemia. Pasteur followed these discussions with keen interest and set about to examine discharges and secretions from such infections. He found in all instances the presence of a microbe which has the appearance of strings of beads (the organism known today as the streptococcus). He had no hesitation in declaring this organism to be the commonest cause of infection in women after delivery. In one of these discussions Pasteur declared it is the doctor and his assistants that carry the microbes from a sick woman to a healthy one.

The year of 1880 was a strenuous one. In April of this year he addressed a note on Bacterial Nature of Plague. In October he read an address at the Academy of Medicine on Vaccinia and Variola. In December the same year, he began his work on rabies—but

his greatest success during this year was his work on chicken cholera. Pasteur succeeded in finding the germ which was the cause of this disease and first observed in 1869 by Moritz, a veterinary surgeon. This germ was successfully cultivated on artificial culture media and always produced the characteristic disease when inoculated into fowls. The course of his experiments was interrupted by a period of vacation. On his return he was annoyed when it was found that these cultures failed to produce the typical symptoms of the disease when injected into the fowl. To his surprise the inoculations instead of proving fatal, produced but slight symptoms and the fowls shortly thereafter recovered. After some trouble Pasteur procured fresh cultures of the chicken cholera organisms. Fresh fowls when injected with the latter soon died, exhibiting all the characteristic symptoms of chicken cholera. But when these fresh cultures were injected into fowls which had previously been inoculated with the long-standing cultures, no characteristic symptoms were produced. It seemed that those fowls that suffered from the mild form of the disease produced by the old cultures were protected from further attacks of the disease.

One of the great mysteries of medicine had thus been revealed. The attenuation of a virulent micro-organism (that is the loss of its disease inciting power) had been attained by the increased age of the culture. Pasteur soon introduced practical methods of immunization in which he shows that the attenuated culture when inoculated gives the same disease but not in the fatal form, with the result that after recovery the animal is able to withstand the inoculation of a virulent strain of the same organism. He immediately began to practically apply his new theory by providing old cultures for the inoculation of fowls in districts where chicken cholera produced serious ravages.

The inoculating substance was called vaccine and the method practiced of immunization was called vaccination, so as to honor the English physician Jenner, who first introduced methods of inoculation to protect against smallpox.

Mention was made previously that Pasteur was working off and on on anthrax. With renewed enthusiasm he proceeded to produce a vaccine material for anthrax. Here he had a more intricate problem as the anthrax bacillus is not weakened with age because it is capable of producing spores. His method of attenuating this organism consisted in exposing the cultures of the organism for vari-

ous lengths of time over a period of successive days at a temperature slightly higher than the maximum temperature at which the organism will grow. After many difficulties and a number of investigations Pasteur succeeded in immunizing sheep and other animals against anthrax. The Society of Agriculture of Melinn had proposed to Pasteur a public trial of this new method. In was in May, 1881, that Pasteur gave this public demonstration and conclusively established the value of anthrax vaccination.

In August of 1881 Pasteur attended the International Medical Congress in London, and in December the same year he was elected a member of the Academie Francaise.

From anthrax Pasteur went on to the study of swine erysipelas, rouget, swine fever or red disease of pigs, as it is at times known. One of Pasteur's collaborators, Thuillier, isolated the causative agent, and within a few years Pasteur had established a method of protective treatment.

At about this time Pasteur began to receive many medals from different societies and communities who wished to show their gratitude to him. In 1883 the national recompense which was awarded to Pasteur in 1874, was raised from 12,000 to 25,000 francs. On July 14th, of the same year, he was invited to be present at the placing of a commemorative tablet on the house in which he was born at Dole.

The government offered Pasteur the Grand Cross of the Legion of Honor in tribute to his great discovery of splenic fever and anthrax vaccination. This he condescended to accept only after one condition was met, and that was an award of the red ribbon or cross for his two collaborators—Chamberland and Roux.

While the various researches were being closely watched by Pasteur one study seemed to be placed above all others. This was Pasteur's work on hydrophobia or rabies. Human rabies is as a rule caused by the bite of a mad dog. It does not appear in all those bitten, but once it shows itself it is almost invariably fatal. The mortality which it causes is slight, but the great dread is the hold which this disease has on the imagination. At times on account of the latter conditions the symptoms that appear are often horrible. It was due to this fact that in December, 1880, Pasteur took in hand the study of rabies. As he began to observe a number of cases of rabies in animals and in humans he soon became convinced that the infection has its seat in the nervous system and particularly in the medulla oblongata. While working along these lines, he examined

the saliva of those who had died of rabies. He succeeded in obtaining an organism from one of these cases in the early part of December, 1880. He further succeeded in culturing this organism, but found that on inoculation into various animals, symptoms were produced entirely different than ordinarily found in rabies, and different than observed on inoculation by any other known microbe. Following up the study of this new organism he found it in the saliva of people who had died of any disease as well as in the saliva of normal healthy individuals. He soon thereafter came to the conclusion that this organism as well as the disease which it produced had no connection with rabies. It is the same organism which Sternberg in this country reported the same year. A few years later it had received the name of pneumococcus after Frankel, who demonstrated its presence in the lungs of persons who had died of pneumonia.

Pasteur, therefore, was compelled to use the medulla oblongata, as he felt assured the causative agent of rabies was confined to this tissue. By means of the latter he successfully produced typical rabies in other animals. He further proved that the virus was present not only in the brain, in the bulb, but in the entire cord and in the nerves. Unable to definitely establish this specific causative agent he continued his researches with the idea of attenuating this virus and estabished a method of prophylaxis. By a series of passage of the virus from rabbit to rabbit, he finally succeeded in obtaining a uniform virus which possessed a fixed virulence, producing rabies after only a one week period of incubation. Further passage from animal to animal did not tend to further reduction of the incubation period. His method of attenuation in this instance consisted of suspending the cords (specifically of fixed virulency—therefore known as virus fixe) in a series of flasks, at the bottom of which there is placed several pieces of potash. He found that the longer the period of time in which the cord remains suspended, the less virulency did the particular cord possess; and, finally, if exposed for a period of fifteen days all virulency seemed to have disappeared. His method of inoculating humans with these cords starting with those that possess slight virulency and increasing not only the dosage but also the use of more virulent cords was soon introduced. Long and bitter was the opposition to the introduction of this so-called Pasteur's method of treatment. The attacks were numerous, and all seemed to refer to the failure of finding the causative agent, but

the existence of a claim of having discovered a cure. In spite of all wherever the Pasteur treatment for rabies was introduced the number of deaths following the bites of rabid animals were greatly reduced. Most all countries and many of the governments after careful investigations officially recognized the value of the Pasteur treatment as it became and is still known today and introduced it in their respective countries. Pasteur Institutes sprung up all over the world in many of the leading countries, and Pasteur lived to see the crowning of his work on rabies, when in November, 1888, the Pasteur Institute in Paris was opened. Today it is estimated that there are close to seventy such Pasteur Institutes.

In 1884 Pasteur had represented France at the International Medical Congress at Copenhagen, Denmark. The enthusiastic demonstrations which took place in his honor were numerous.

When the Pasteur Institute was finally completed, due to the hearty support of both rich and poor in subscribing to the building fund, he moved his quarters to the Institute. He, however, was ill and weary. He attended the hydrophobia clinic almost daily and superintended the production of the vaccine material. At the same time he was constantly offering suggestions to his assistants, especially Dr. Roux and Dr. Yersin, who were pursuing the study of diphtheria. Later when Dr. Yersin began his wonderful work in Asia, working in areas in which Bubonic Plague was epidemic, Pasteur followed with great interest the communications sent to the annals of the Pasteur Institute. It was Yersin who discovered the causative agent of Bubonic Plague.

During May of 1892, a committee was formed in Denmark to celebrate Pasteur's seventieth birthday on December 27th. The movement spread to Norway, Sweden and finally to France, where a committee was formed for raising subscriptions towards "Offering a remembrance and a tribute to their illustrious patriot on the occasion of his jubilee." On December 27, 1892, one of the greatest receptions ever given any living man took place in France. Many men from all walks of life made speeches and presented addresses. It would be impossible to attempt to mention even some of the important ones, but a few of the remarks with which Lister greeted Pasteur are of interest:

"Truly there does not exist in the whole world an individual to whom medical science owes more than to you."

"Your researches on fermentation threw a powerful light, which has illuminated the dark places in surgery and has changed the treatment of wounds from an uncertain, empiric and too often disastrous business into a scientific and certainly beneficial art. Thanks to you, surgery has undergone a complete revolution, which has deprived it of all its terrors and which has increased its efficacy to an almost unlimited extent."

It was in September, 1895, as Pasteur's career was coming to its close, that he saw about him the entire routine of the making of diphtheria antitoxin, the discovery of which was announced the year before. On Saturday, September 28, 1895, at 4.40 in the afternoon, Pasteur passed away very peacefully.

Pasteur's ashes repose in a beautiful chapel situated below the main entrance, a little lower than the ground floor, of the Pasteur Institute. The walls of the chapel are inscribed with the scientific triumphs of the master whose ashes repose there. It is a striking array of headings, representing a great step forward in science.

His devoted wife died September 24, 1910.

There is said to exist a constant warfare between science and religion. It may be that there is such a conflict, but if we turn to the pages in which are recorded the sayings of the real great, we are inclined to believe that such warfare, if at all, is only present in the narrow minds of the lesser lights.

It is interesting to note the simple expressions in which Pasteur at times attempted to explain his ideas about religion. In his address as newly elected member to the Academy of Science, the following remarks are quoted from his address: "Everywhere in the world I see the expression and idea of the infinite. Owing to it, belief in the supernatural is found in the bottom of every heart. The idea of God is a form of the idea of the infinite." He refers to the Greeks and says: "It is they who have bequeathed to us one of the most beautiful words in our language, the word enthusiasm—an inner God. The greatness of human actions is measured by the motives which inspire them. Happy are those who carry within them a God, an ideal of beauty which they obey, the ideal of art, the ideal of science, the ideal of country, the gospel idea of virtue. Those are the living sources of great thoughts and great actions. All are lit by reflections of the infinite."

Pasteur encountered many difficulties and many obstacles, but with the high quality of thought which constantly guided him he al-

ways outflanked these obstacles. Unlike the generality of great men, he, however, enjoyed the meed of almost unstinted appreciation during life.

Pasteur looked upon the cult of great men as the great principle in national education, and he constantly advised students to worship great men.

He was always irritated when scientists involved in arguments over their problems brought in for consideration the question of nationality. It was at a banquet at the close of the International Congress on Sericulture held at Milan that Pasteur pronounced the words so often repeated: "Science has no country, but the scientist has one."

Those of us who are interested in research and in teaching may obtain considerable food for thought from some of the following remarks attributed to Pasteur. In his Lille speech, the sentence "in the fields of observation, chance only favors the mind which is prepared," was particularly applicable to him. "At the beginning of an experimental research on any fixed subjects, wings must be given to the imagination. At the moment for drawing conclusions and interpreting collected observations the imagination must on the contrary be made to give way and submit to the actual results of the experiments."

He wrote in the preface to his "Studies on Silkworm Disease": "It is the glory of the man of science to esteem discoveries which at their birth can only be appreciated by his equals far above those which immediately earn public favor by instant application; but in the face of misfortune it is equally glorious to sacrifice everything in order to try and be of assistance."

Pasteur said to his pupils, "Without theory practice is but the routine of habit. Theory alone can awaken and develop the spirit of invention."

In his communication on February 10, 1862, to the Academy of Science on the "New Industrial Method on the Fabrication of Vinegar," he gave the following warning:

"As it often happens that scientific principles published by their discoverers are made use of by others, with the addition of apparatus or some insignificant modifications, for obtaining patents of invention, I have, by the advice of competent persons, and before making my communication of February 10th, taken out a preliminary

protection forestalling the patenting of all inventions to which my work may give rise, and I add that I am resolved to let this lapse from today for the benefit of the general public."

There are many examples of Pasteur's insight, his ability to discover and state a problem, of the patience with which he gathered together information. He lived in advance of his time. He lived with his thoughts without being a dreamer for his dream so regarded at the beginnning, eventually bore fruit.

It is, therefore, fitting that during this month scientists and everyone are uniting the world over to honor this genius on the centenary of his birth, he whose work has proven of such great and practical utility for mankind, and whose knowledge and discoveries are even today beginning their career of developing suggestions and thoughts to scientists.

"THE CRISIS IS UPON US."

An Address.*

By John Uri Lloyd.

Mr. Chairman and Friends: Nothing have I prepared to offer as an address. Months ago I started to write one on a very vital subject, but when nearly through came the crash of this war. Then I shoved the paper back on my desk, because I felt, as I know you also do, that these be not times for studied formality, made under the cold touch of a laboratory in which my life is spent. Let me informally speak that which comes now, touching perhaps some phases spoken before, but of necessity not until now systematically formulated.

It has been said that if there be any inflexible law, it is the law of exceptions. Should a man lay down a rule to follow through life, he will find if he lives long enough, that there comes a time that there must be an exception to previous idealistic processes of reasoning, and, necessarily, if he be yet elastic in thought, change in action follows.

*Delivered informally at the meeting of the National Eclectic Medical Association, Detroit, Mich., June, 1918.

Let me take as my text, the expected (as our people see therapeutic problems) has unexpectedly (as some others view them) happened.

Listen! Thirty-five years ago it was proposed to introduce a pharmacy law in the state of Ohio. A few pharmacists, in Cincinnati, Dr. Greve, a member of our society, and myself—probably first foresaw the wrong the pharmacy law, as introduced, would do, both to the cause of the people and of pharmacy. As we looked upon it pharmacy laws, if instituted, should be designed not to help the colleges alone, but primarily, continuously and eventually, the people. Many times did we go to Columbus and endeavor, by the aid of the united pharmacists of Ohio, to get what we believed to be a fair pharmacy law, designed to care for the people as well as for the college interests. And we succeeded. The argument made was simply a statement of fact to the following effect:

If the proposed draft is passed, as presented, and becomes now a law in Ohio, there will be few pharmacists left excepting in the large cities, and the majority of these will be put out of commission. Very few pharmacists have college of pharmacy diplomas; comparatively few can leave their places of business now to attend college. Not a doctor in the State of Ohio, if this law passes as introduced, will be permitted to supply medicines to the people. Not a crossroads general store or grocery can carry such simples as copperas, or bluestone, or castor oil, or Epsom salts; indeed, general chemicals used as dyestuffs.

We insisted that we not only favored regulation of pharmacy where ignorant or harmful processes might work to the people's injury, but believed in the utmost practical education for pharmacists.

We began our argument as a minority, which in the end became a majority, both with pharmacists and our lawmakers. The law, as passed, was at that date a balanced law that, based upon the then present conditions, favored progress.

A few of us foresaw the future—all knew the present. The future was theoretical—the present a fact. By dwelling upon possibilities based upon the present, we were able to indicate the probable future.

One of our amendments was to the effect that a person not a pharmacist might properly own a drug store, and, under balanced restrictions by a state pharmacy board, employ competent pharma-

cists. Just then a forceful example pended as a text. A prominent pharmacist in Cincinnati (K. B. Ashfield) died and left his two stores in the hands of his widow. Under the law introduced by the College of Pharmacy, she would be compelled at once to close the doors of those two establishments or sacrifice her heritage. The law-makers saw the force of our argument.

As is the case when a person attempts to stem ultra-enthusiastic effort, especially when personal interests are concerned, we had to meet the charge that we were opposed to higher college education. This was an error, because the prime mover, Dr. Greve, was a long-standing trustee of the College of Pharmacy, and I occupied the chair of pharmacy. With few exceptions, the college trustees and professors finally became our allies. We were all in favor of education, but yet argued that the colleges of pharmacy (university departments of pharmacy had not yet come into their responsibility) could gradually bring the entire practice of pharmacy into the hands of parties professionally educated and qualified. We counseled balanced effort that would bridge the present, and in the end would prove effective in all possible educational pharmaceutical directions.

Now to the application of this old-time text. Medicine is in some regards in the position pharmacy occupied forty years ago. The law-maker is besought to care for all concerned—colleges, universities, above all, *the people*. Let us not underrate their responsibility. Let us not shrink from our own responsibilities.

It is often difficult for persons concerned in purely academic phases of education to distinguish between idealistic aims and practical possibilities. Nor is it possible for an enthusiastic member of a dominant party to tolerate the opinions of a minority. Let us give an example:

Five years or more ago it was my privilege to sit by the side of a man known as a great educator in medicine. This man stood second to none in this cuntry in his earnest belief in the *immediate* application of idealistic "higher medical education." He was honest, energetic and self-sacrificing. He believed every word he said. In the discussion that occurred, I spoke as candidly on therapeutic processes as I had thirty years before to the Ohio legislature on pharmacy problems. Said I, concerning enforced "higher" medical education: "If you keep on with what you denominate higher medical education, and enforce restrictive laws to the limit, you will reap the opposite

of your ideals. Not only will you fail to accomplish for the people, but I fear will put the medication of this country into the hands of the so-called *patent medicine men.* I am an enthusiastic believer in university education as regards exact sciences and fundamentals, but I am not a believer in indiscreet processes that, unwisely applied, limit or disturb the country's opportunities and prohibit freedom in thought."

"What do you mean, Mr. Lloyd?" he asked.

I replied: "All the university departments in medicine of this country cannot, under the proposed plan, replace physicians who annually die. Nor are there applicants now ready to take the proposed courses. In my judgment, those who graduate under the proposed plan will have advanced opportunities as *specialists*, but this very fact will lead them to locate as specialists in our cities. If this surmise is proven correct, I would ask, where will rise the physician to care for the sparsely-settled desert or mountain? In my opinion, a loved one in a hamlet on the desert is as precious as he who lives in a palace. To provide self-sacrificing physicians in sparsely-settled locations is as much a charge of our lawmakers as to care for him living in a palace. No law should be either instituted or enforced that does not care for both, if it cares for one.

"As an example, I have in mind a location in Kentucky where a father put his all into the physician schooling of a boy, according to this extended education scheme. He graduated with honor, and we are all proud of him. Did this boy go back to his crossroads home in Kentucky to practice medicine? No, he became a specialist in a great city. Six years of time had been spent as well as his father's fortune. He could not afford to go back to the limited field of the crossroads, where patients afflicted in the direction of his specialty were as scarce as odd rows of corn on the cob.

"In the furtherance of your worthy aim, denominated 'Higher Medical Education,' you should comprehend that during the transitory interval the supply of physicians must be maintained, not in the cities alone, *but in the whole country.* May I not ask you to permit me to use the term 'balanced medical education' or 'advanced medical education' instead of '*higher* medical education?' Is there any education *higher* in its sacrifices for humanity than that of the self-sacrificing physician of the olden time, qualified to the limit in general practice?"

This was his answer: "Mr. Lloyd, if we cannot have a doctor of the highest qualifications at the crossroads, I believe these people should have no doctor at all."

"This view I consider almost criminal," was my reply. "Listen! My family physician, Dr. R. L. Thomas, who followed in my family Dr. Locke, I consider, as a family physician, second to no graduate who has passed this 'higher' education program. When he visits a loved one sick at my home, I have all the confidence in his care and his advice that I would have in any one. He spent two years in a medical college that believes in therapeutic action of properly selected remedies and went immediately into active practice. But previously, he had two years under a qualified preceptor, versed in directions that make the practice of medicine a successful family practice, and he has now over thirty years of subsequent experience. He knows how to treat disease, he understands materia medica, and he is competent to judge as to when an ailment needs a specialist. And yet your view concerning the term 'highest' would discredit such men as these.

"Listen! We have already many advanced university specialists in surgery, in microscopy, in involved diagnoses, and in other sections. As a rule, they are located in cities, or in hospitals and sanitariums. Every one is proud of them. A wonderful opportunity for such phases of education does a university offer. The family physician does not pretend to be ultra-expert in all such specialties. The great province of the university that we all uphold, is (or should be) to extend the field of exact knowledge, to teach applied fact, to permit of independent thought concerning therapeutic opinions, and to serve humanity.

"Let me now tell you what *unbalanced* processes, idealistic to the degree in an academic sense, will, in my opinion, accomplish. Before comes a supply of physicians for America under proposed processes, famine in physicians must occur. As a result, *the country will be turned over to the cults, and our people medicated by the patent medicine advertisers.* And, in my opinion, there will be no freer supporter of excruciatingly long and expensive medical courses than the so-called patent medicine man and his advertising publishers. Why should not this be the case? Every section of the country that, by restrictive processes, has no physician, is naturally turned over to

almanac and advertising literature. Is it not to the interest of the home-cure *business* that there should be *no doctors?*"

This ended our discussion, which was not personal, but yet intensely earnest. I accepted his sincerity in behalf of hopeful medical advancement, but did not believe in his methods of procedure. Nor do I yet. In my opinion, he accepted what I believed to be unwarranted conclusions, in which he surely considered me erratic,—"irregular."

Behold! The apprehended crisis came upon us. One by one, during recent years, the all-sufficient doctor, the faithful family physician of the olden time, has been passing away. Too often, no man is there to take his place. Standard medical colleges, the outcome of a century's effort, colleges that graduated the teachers of today in both college and family practice, and that, were they still in existence, would be feeders of the university advanced special students, have, under methods rashly (unwisely) adopted, one by one, closed their doors. Only a few are left. The Medical College of Ohio (Cincinnati) is closed. The Miami Medical College is closed. They have given their honored names to the University of Cincinnati. The College of Medicine and Surgery and the several other colleges of medicine in Cincinnati, excepting the Eclectic, all are closed. Seven Cincinnati medical colleges have gone out. Surely they were not all unworthy. Excepting the University Medical College, which we all honor, only the Eclectic Medical College is left. Is such as this not the record of the whole country? Need one have been a prophet, or the son of a prophet, to foresee that the extinction of these institutions, without replacement, would breed a physician famine?

Think you that the family near that Kentucky crossroads needs no longer a doctor? Think you that the families on the plains of the West, where for fifty miles around, perhaps a greater distance there is now no physician, need no doctor? Think you that in the little home on the mountain side no doctor is now needed?

Surely our educators and lawmakers will arise to this emergency. They must do so. The care of the American home is a necessity. I bespeak not any relinquishment in general university education—rather in some directions its *enlargement*, in others curtailment. The term *university* permits not the thought *restriction*. I ask no open door for colleges to turn out either the ignorant or the charlatan. The term *college* prohibits such a definition.

In my opinion this problem should be met. Under a balanced system of medical education (mark well the word *balanced*) the family physician must again come into his own. The family doctor, who all admit has done such a great humanitarian work in his self-sacrificing calling, and who no man has a right to slur and despise, is surely not destined to become extinct.

CORN AND ITS PRODUCTS.*

By Freeman P. Stroup, Ph. M.

(Professor of General Chemistry at the Philadelphia College of Pharmacy and Science.)

Corn is a common Teutonic word, meaning originally a small, hard particle or grain, as of salt, sand, gunpowder, etc. Later the term came to be applied to small, hard seeds (barleycorn, peppercorn, etc.). In agriculture it is usually applied to the seed of cereal plants, and has often been understood locally to mean that kind of cereal which constituted the leading crop of the district, *i. e.*, in England, wheat; in Scotland, oats; in the United States, maize (Indian Corn).

Corned, as applied to meat, meant originally meat (beef generally) preserved by the use of salt in grains or "corns." At present the term applies to meat preserved by the use of solutions of salt.

Corn, as applied to the toe variety, is derived from the Latin "cornu," meaning horny, though not all toecorns are horny.

Indian Corn, Zea Mays, seems to be unknown in the native state, but is probably indigenous to tropical America. Small kernels have been found in ancient tombs of Peru. By some it has been thought to have come from Asia and is said to have been carried by the Arabs into Spain in the thirteenth century. A drawing is said to have been found in a Chinese work dating back to 1562, seventy years after the discovery of America by Columbus. It is not

*One of a Series of Popular Lectures given at the Philadelphia College of Pharmacy and Science.

figured on Egyptian monuments, nor was any mention made of it by eastern travelers in Asia or Africa prior to the sixteenth century. Humboldt and others do not hesitate to say that it originated solely in America, probably in Mexico, where it had been extensively cultivated for many years before Columbus' appearance on this side of the Atlantic Ocean. He found natives of the West Indies eating cakes made from the new grain which they called "mahis." Pizarro found the Peruvians using it for food and for making an alcoholic beverage. The Pilgrim Fathers found a cache of it back of Plymouth Harbor.

Botanically speaking, corn belongs to the grass family (order of Gramineæ) and is of many varieties, more than 2000 named varieties having been catalogued. These may be roughly grouped under five heads: the *Pop-Corns* (Zea Mays everta); the *Dent Corns* (Zea Mays indentata); the *Flint Corns* (Zea Mays indurata); the *Soft Corns* (Zea Mays amylaceæ); the *Sugar Corns* (Zea Mays saccharata), commonly called sweet corn. *Broom Corn*, the tops of which are used in the manufacture of brooms, belongs to a different class of grasses and will not be here considered.

Depending upon the variety, the weather conditions, the nature of the soil, the amount of cultivation, and other factors, corn grows to a height ranging from a few feet to twelve feet or more. Fabulous statements have come out of certain sections of the Middle West as to the height to which the plant has grown. The diameters of the stalks vary with the height, and the relative closeness of the plants in the field.

The flowers are of two kinds, the staminate or male flowers constituting what is commonly known as the tassel, and the pistillate or female flowers and their supporting stem and sheath constituting the ears. On any given stalk the staminate flowers mature first and shed their pollen before the pistillate flowers are ready for pollination. This prevents inbreeding and explains why isolated stalks fail to bear grain on the cobs. The tassels are borne on the ends of the stalks, the ears in the axils of the leaves. The number of ears on a stalk varies from one to three, rarely more. The pollen from the tassels is scattered by the wind and fertilizes the ears on neighboring and, sometimes, quite distant stalks whose pistils, collectively called "Corn-silk," are ready for pollination. If pollen grains come in contact with all the fibers of silk on an ear the em-

bryo grains attached to the lower ends grow and we have a so-called "well-filled ear." In order to ensure well-filled ears corn should never be planted in single rows but, rather, in plats, or "patches."

Some varieties of corn mature in two months from date of planting and some require as much as seven months. The nature of the soil and, particularly, the climate have much to do with the rapidity of maturity. Corn can be grown in the Tropics from the sea level to several thousand feet above sea level; it can be raised in the middle and south of Europe, but not in England, with any chance of profit. It is extensively grown in India and in the United States, and constitutes the most common crop of South Africa, where it is known as "mealies" and furnishes the chief food staple of the natives. It thrives best in regions where the rainfall annually averages around 30 inches, or in sections which can be frequently irrigated. All other things being equal, it thrives best when there is a succession of hot nights during the height of the growing season, the rate of growth often being so rapid that one "can almost see the corn grow." It has been estimated that 300 pounds or more of water are required to produce one pound of dry matter in the corn stalk.

Closely planted, either broadcasted or drilled, corn makes an excellent forage crop. Special varieties which grow rankly to form stalk and leaves, and known as ensilage corn, are widely cultivated, the stalk cut while still green and full of sap, stored in tall structures known as silos, where it undergoes fermentative changes, and from which it is fed to live-stock during the winter months when pasture is not available. The yield may be as much as 80,000 pounds to the acre. Where a silo is not available for storage the so-called "sowed-corn" is cut while still green and cured much as grass is cured for hay, and stored in the same way as hay is stored.

When corn is grown for the grain it is to yield it is planted in so-called "hills," three to five kernels in a hill, the hills 3½ to 4 feet apart in rows about the same distance apart; or the kernels planted at intervals of about 9 inches in rows, the rows being 3½ to 4 feet apart. Some growers plant only one or two kernels in each hill. Too close planting makes for small ears, too thin planting is a waste of ground and makes often for imperfect pollination. The seed-bed should be well prepared by deep plowing and thorough working to make it possible for the roots to penetrate deeply to give

firm anchorage to the stalks and to provide abundant storage for moisture, as well as to prevent too free evaporation of the moisture. All other things being equal, the more thoroughly and frequently the soil between the rows is loosened the better for the growth of the crop, not only as a means of keeping down weeds which impoverish the soil, but also as a means of destroying the capillarity of the top soil and thus preventing evaporation of the moisture stored in the lower layers.

Pop Corn Group.—To this group belong a number of varieties which yield kernels which, when mature, are small, rounded or elongated, hard, smooth, generally white to yellow, sometimes red to purple. When these are heated to about 150 degrees Centigrade (302 degree Fahrenheit) they explode, forming a very much enlarged, irregular, white mass in which the starch grains are no longer recognizable under the microscope, they having been ruptured in the popping process. The explosion of the starch grains is materially influenced by the water content of the grain, the popping proceeding most satisfactorily when the kernel contains 10 to 12 per cent. of moisture. This explains why corn of this kind which has been stored in a warm dry place does not pop well.

Sugar Corn Group.—To this group belong many varieties which yield grain in which the sugar content is more or less highly developed, as much as 8 per cent. in some varieties when in their prime, though much lower in others. The quicker-maturing varieties ("Early Corn") are usually less sweet than the slower-growing varieties ("Late Corn"). Sweet corn is usually eaten while in the unripe state, while the starch is still soft and the sugar content is at its maximum. The sugar which is in the kernel while on the stalk rapidly disappears after plucking the ear, and particularly after the removal of the outer leaf covering or husk; hence the corn should be cooked within a very short time after its removal from the stalk, if its greatest sweetness is to be enjoyed. People who get their sweet corn from city markets or from street peddlers do not realize what the owner of a kitchen garden enjoys in the corn line.

A great deal of sweet corn is made available for winter use by (a) drying in the sun or by aid of artificial heat the uncooked or partly cooked kernels, (b) modern dehydrating processes, and (c) canning processes.

The matured kernel of sweet corn (fit for planting) may be smooth and rounded or very much shrunken and wrinkled, the sweeter the corn the more wrinkled, usually, the seed. Most varieties yield a white seed, some yellow, some red to purple. There are hundreds of named varieties, but the differences between the characters of some are very slight.

It is interesting to note the arrangement of the kernels on the cob, as the grain support is called. Generally they are in rows running lengthwise of the ear, sometimes spirally, and sometimes not in rows but arranged very irregularly. The number of rows is generally even (the author has never seen an ear with an odd number of rows of kernels, nor has he ever met a person who could state positively that he or she had seen such an ear). The minimum number of rows ever seen by the author on any one ear was eight and the maximum twenty, though some authorities state that some varieties yield ears containing twenty-four rows. The number of kernels in a row varies very greatly, some so-called "nubbins" having only a very few, while fully developed ears may have fifty or more. An ear of fourteen rows of forty kernels each (an average sized ear) is thus seen to hold nearly 600 kernels, and when this number is multiplied by 3, the number of ears frequently found on a single stalk the result is so much greater than the biblical "sixty to a hundred-fold" that Indian Corn could not, by any possible stretch of the imagination, have been the grain referred to in the "parable of the sower."

Field Corn.—This is a name frequently given to certain varieties of corn whose ears are allowed to come to maturity and the fully ripened grain is desired. There are several types of field corn, the grain from each type having properties which adapt it for some special purpose or purposes.

Zea Mays amylaceæ, which yields a rather soft grain, is largely cultivated in the Southern States, and plays a very important part in the daily dietary of the population, particularly of the poorer classes, where it appears on the table in some form or other generally at least once a day. Hominy is generally made from this variety of corn.

Zea Mays indurata (Flint Corn) and Zea Mays indentata (Dent Corn, so named because of the dent on the outer end of the kernel) constitute the chief types of field corn grown in the

Northern and Western States, and constitute the bulk of the annual great American corn crop. The 1921 crop, according to statistics compiled by the Department of Agriculture, was more than three billion bushels. Because of extensive drought in much of the so-called "Corn Belt," this year's crop, as forecasted by the Department of Agriculture statisticians, will be about 225 million bushels less. The sweet corn and pop corn crops are not figured in these estimates. Upwards of a hundred million acres of ground are annually devoted to corn culture, which means an average production of thirty bushels per acre.

Harvesting of the Crop.—Sometimes the stalks are allowed to stand until the grain is thoroughly ripened, when the huskers go through the fields, row by row, opening the husks, breaking out the grain-bearing cob. More generally the stalks are cut off near the ground either by hand-wielded knife or by special corn harvesters, and the stalks collected and arranged in "shocks" and allowed to stand some time for thorough curing before the husking is done. The husking is done by hand, either from the ears previously broken from the stalk, or while yet on the stalk. At one time it was quite a common custom in many localities, particularly among the young people, to hold so-called "husking-bees." The amount of corn actually husked on such occasions was usually rather negligible, but the fun that was gotten out of the affair was generally "a-plenty." Apples, cider, nuts, pastry were the chief "refreshments," and dancing was often a part of the entertainment. Husking-bees are rarely held in these days, except as friends and neighbors occasionally get together to do for some sick or otherwise disabled person that which he cannot do for himself. On such occasions the social features play only a minor role.

The dried stalks and husks are much used for fodder for cattle (so-called "roughage") sometimes being given in the whole condition, sometimes shredded or cut. Often they are left in the fields over winter and allowed to rot, after which they are "plowed under" in the spring, having some value as a fertilizer. Some of the thin, paper-like, clean inner leaves of the husks were at one time quite a popular filling material for mattresses, for beds, and occasionally some have found use as a substitute for tobacco in the making of cigarettes. And who, among the older people now living who

were brought up on a farm, does not remember the delicate(?) flavor of the corn-silk cigarette as smoked "out behind the barn" where the watchful eye of father or mother could not see?

The Corncob, the portion of the ear to which are attached the kernels and constituting 10 to 14 per cent. of the weight of the husked ear, has a variety of uses. It makes an excellent fuel, having a high heat value, the chief drawback to its use being that it burns so rapidly that fires made with it require such frequent attention. It is sometimes used in place of hickory or other hard woods in the smoking of meats. Real corncob tobacco pipes are well known in some sections, tool handles are sometimes made of corncobs. Chemists in the Department of Agriculture at Washington are said to have worked out a process for the making of furfural from corncobs, the furfural to be used instead of formaldehyde in the manufacture of synthetic resins of the Bakelite, Condensite, Redmanol type. This will conserve the supply of formaldehyde, the methanol from which it is made and the hard woods from which the methanol is made. Furfural is said to be also a possible motor fuel. It has been made from oat hulls and has been selling for about 50 cents a pound, but when made from corncobs the estimated cost will be about 10 ents a pound.

The Kernel.—The corn grain or kernel varies as to size, color, shape and hardness, the variety, the conditions of growth and ripening, the climate and many other factors, each playing a part. By weight it contains, on the average: water, 10.75 per cent.; oil, 4.25 per cent.; protein, 10 per cent.; fiber, 1.75 per cent.; mineral matter, 1.5 per cent.; starch and sugars, 71.75 per cent. It is richer in albuminoids (protein) when ripe than any other cereal, as well as richer in oil; hence flour or meal made from it becomes rancid more readily than flour made from other grains.

Corn Meal was formerly made by grinding corn between stones, bolting to get rid of chaff (bran). Modern milling methods remove the bran and most of the germ (which contains the oil), the resulting product having better keeping properties than the old-time meal. Meal intended for export is being largely made from a degermed grain with the result that much of the prejudice against corn flour has disappeared from European countries where it once existed in a very pronounced form. That was largely why we were

expected to eat more corn in this country during the World War, that wheat could be sent abroad to the people who would not eat corn. Much of what had been shipped them had become rancid on the way over, if it was not already so when shipped. Even in normal times corn meal finds its way into many dishes for the American table. It may not be known to many people today that a hundred years or so ago mush and milk was considered a great delicacy, and hotel and restaurant keepers in Philadelphia advertised in the newspapers that on certain days they would have mush and milk on the bill of fare. Because of the lack of agglutinating power of the nitrogenous constituents of corn flour corn bread and similar products are not usually as light as those made from wheat flour, much of the carbon dioxide gas from the leavening agent escaping before baking has far advanced. Incidentally, for the same reason, pie crust and other baked products made from flour containing corn flour are not as tough and leathery as they often are when made from wheat flour alone.

Much of the corn produced in the United States is not utilized in the making of flour, but is "worked" for the oil and starch it contains. For this purpose the cleaned grain is steeped in water for from three to ten days at a temperature around 140 degree Fahrenheit to soften it, the water being changed frequently to prevent fermentation. Sometimes sulphurous acid is added to the steep water. The steep water, on evaporation, yields a product which, when mixed with other by-products of the industry, serves as a cattle feed.

By means of suitable machinery the softened grain is separated into three parts—the hull, the germ and the endosperm (body). The germs are dried and subjected to pressure in suitable presses to separate much of the oil, the press-cake being afterwards used chiefly in cattle feed. The endosperms are separated into gluten and starch by kneading with water on sieves, the starch and water passing through. The gluten is mixed with the hulls and solubles obtained from the steep water, the mixture dried and sold as gluten feed for cattle. The milky starch liquid is treated with alkali to render soluble any gluten and oil that may be in it, and the starch is afterwards thoroughly washed with water. One bushel (56 pounds) of corn yields about 28 pounds of starch and about one pound of oil.

Corn Oil when properly purified is a neutral bland oil which may be used as a substitute for lard as a cooking oil, and is a good substitute for olive oil as a salad oil. The poorer grades are used in the manufacture of soaps and a rubber substitute suitable for the manufacture of pencil erasers, synthetic shoe soles, and other articles requiring a raw material having similar properties.

Considerable Corn Starch is used in the manufacture of food products, some of it is used as laundry starch, some of it is used in textile industries as the basis of textile dressings, and a great deal of it is converted into dextrine, dextrose and other alteration products.

Dextrine.—In the manufacture of this product several processes are used. In one process the dry starch is heated to about 212 degrees Fahrenheit in revolving drums which are double-jacketed, the space between the inner and outer walls being filled with oil. After the water in the starch is given off there is but little loss; 220 pounds yield about 176 pounds of dextrine. Dextrine made in this way may be quite brown in color. In another process the starch is moistened with dilute acid before heating. The product is nearly white. In still another process 8 to 10 parts of dried malt are added to each 100 parts of starch, the mixture moistened with water at 70 to 80 degrees Fahrenheit and kept at that temperature for about 20 minutes, or until the mixture becomes quite fluid, when the temperature is quickly raised to the boiling point. After cooling and filtering, the dextrine is gotten by concentrating the filtrate. Dextrine is used as an adhesive in many industries, but particularly as the basis of dressings for fabrics and in the manufacture of mucilages and pastes for gumming paper, stamps, etc. Card board of the finer grades is made by gumming and pressing together sheets of paper, dextrine being the adhesive frequently used. Dextrine is also used for thickening colors for calico and other printing sizes, and in leather dressings and pastes.

Dextrose is a sugar largely manufactured in this country by heating corn starch with dilute acid, generally hydrochloric, formerly sulphuric, until a portion of the mixture when treated with Iodine Test Solution fails to give a blue or red color, neutralizing the acid with sodium carbonate (when hydrochloric acid is used) or lime

(when sulphuric acid is used), filtering through boneblack if necessary, and concentrating the filtrate to a thick syrup or solid. When left in the syrupy form the product is usually known as Glucose and consists chiefly of maltose, dextrose and dextrine and some water. This product is used in the manufacture of printers' rollers, candy, shoe polishes and leather dressings, in liquid soaps, in silvering glass for mirrors, in chewing tobacco, in pastes and sizes, for finishing molds in iron foundries, for mixing with cane sugar and cane sugar syrups for table and baking purposes. When concentrated to the solid form it may be used in the manufacture of caramel (sugar-coloring), and for the manufacture of confectionery products. So-called "Corn Syrups" are generally blends of ordinary sugar and commercial glucose syrup, sometimes flavored with vanilla, maple, etc., for special purposes. They do not often contain over 15 per cent. ordinary sugar.

It has been stated that more than a hundred different commercial substances of value in our everyday life may be properly called "Corn Products," but lack of time makes it impracticable to pursue the subject farther at this time.

EFFICIENCY OF SOME COMMON ANTI-FERMENTS.

By Ellery H. Harvey.

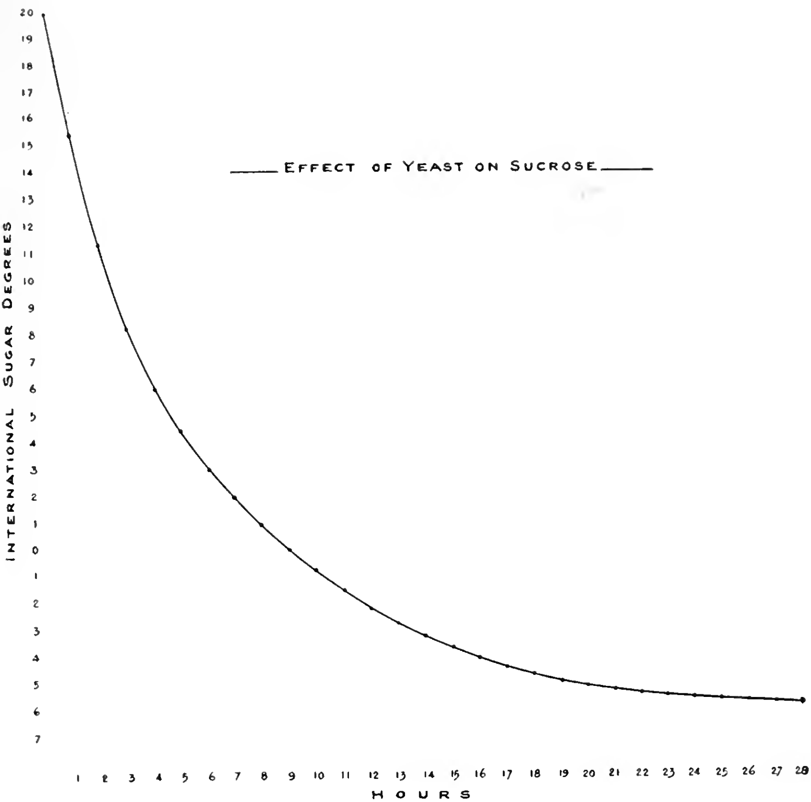
Yeast, due to the enzyme invertase, gradually inverts the disaccharide Sucrose into equal parts of dextrose and levulose. Utilizing polariscopic methods the rapidity of hydrolysis is noted at regular intervals thus obtaining data which on plotting, give a curve that serves as a basis of comparison for the subsequent determinations.

Using the same procedure, given portions of fresh liquid are treated with anti-ferments and the action of the anti-ferment on the yeast is noted by the slowing up of the hydrolysis of the sugar. It follows, therefore, that the greater the change in hourly readings the less efficient is the anti-ferment and vice versa. While not strictly accurate on account of neglecting the possible hydrolyzing action of some of the anti-ferments, the method yields results of reasonable consistency and of sufficient comparative value to make the results quite interesting.

Twenty-six grams of sugar were dissolved in distilled water sufficient to make 250 cc. To this solution was added 3 grams of compressed yeast, a portion filtered and polarized at once and hourly thereafter. The temperature was kept constant at 23° C. The instrument used was a Fric Saccharimeter equipped with an International Sugar Scale. The readings given are those obtained when using a 100 mm. tube and taking the average of five readings, no single reading varying more than 0.5 degree from any other. The filtered portion was used to wash back the residue left on the filter in order to keep volume and reacting materials as constant as possible.

Table No. 1.

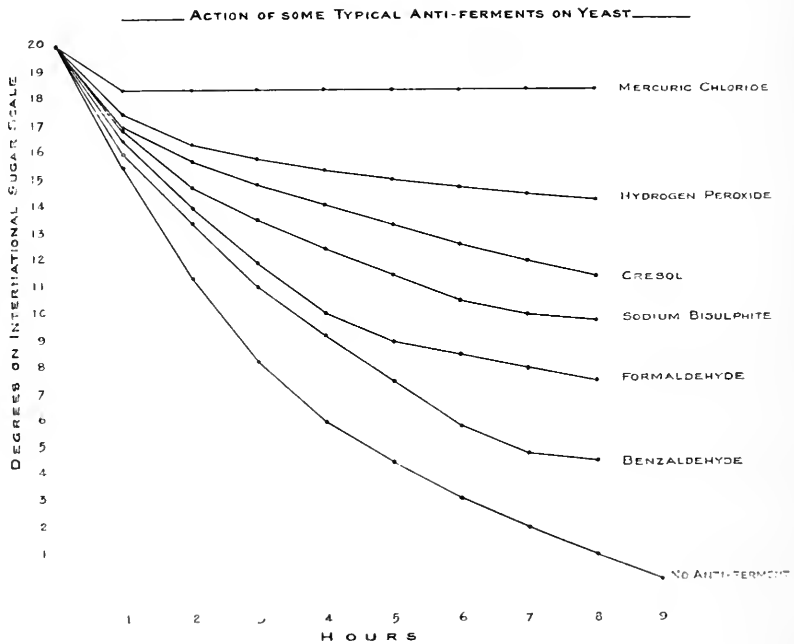
Original			+	20.0	Degrees
End	1st	hour	+	15.5	"
End	2nd	"	+	11.3	"
End	3rd	"	+	8.2	"
End	4th	"	+	6.0	"
End	5th	"	+	4.4	"
End	6th	"	+	3.1	"
End	7th	"	+	1.9	"
End	8th	"	+	0.9	"
End	9th	"		0.0	"
End	10th	"	—	0.7	"
End	11th	"	—	1.4	"
End	12th	"	—	2.2	"
End	13th	"	—	2.7	"
End	14th	"	—	3.2	"
End	15th	"	—	3.6	"
End	16th	"	—	4.1	"
End	17th	"	—	4.4	"
End	18th	"	—	4.7	"
End	19th	"	—	5.0	"
End	20th	"	—	5.2	"
End	21st	"	—	5.3	"
End	22nd	"	—	5.4	"
End	23rd	"	—	5.45	"
End	24th	"	—	5.5	"
End	25th	"	—	5.6	"
End	26th	"	—	5.63	"
End	27th	"	—	5.65	"
End	28th	"	—	5.7	"
End	29th	"	—	5.8	"
End	30th	"	—	5.9	"
End	48th	"	—	6.8	"
End	120th	"	—	6.8	"



For studying the action of anti-ferments on yeast, 114.4 grams of sugar were dissolved in distilled water sufficient to make 1,000 cc. To this solution was added 12 grams of compressed yeast and the liquid divided into 50 cc. portions. To each portion was added 5 cc. of a 1 per cent. solution of the anti-ferment (exception hydrogen peroxide) and the readings taken hourly, conditions and procedure being the same as noted above. The results are noted in Table No. 2, the anti-ferments being listed in the order of their efficiency. Original reading, 20.0.

Table No. 2.

Chemical.	*1st Hour*	*2d Hour*	*3d Hour*	*4th Hour*	*5th Hour*	*6th Hour*	*7th Hour*	*8th Hour*	*Remarks*
Mercuric Chloride	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3	C. P.
Pot. Cyanide	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	40% CN.
Sod. Hypochlorite	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	4% Sod. Hypo.
U. V. R. for 20 Min. ..	19.0	18.5	18.0	17.5	17.3	17.0	16.9	16.8	
Sod. Arsenate	17.8	16.4	15.8	15.4	15.1	14.7	14.5	14.3	C. P.
Hydrogen Peroxide ...	17.5	16.3	15.8	15.4	15.1	14.8	14.5	14.2	5cc. 3% U.S.P.
Methyl Salicylate	17.7	16.3	15.1	14.4	13.7	13.3	13.0	13.0	Synthetic.
Salicylic Acid	15.5	14.3	13.2	12.4	11.6	11.6	11.6	11.6	U. S. P.
Cresol	17.0	15.7	14.8	14.1	13.3	12.6	12.0	11.4	U. S. P.
Furfural	15.8	14.0	12.9	11.8	11.0	10.5	10.0	10.0	Technical.
Aluminum Sulphate ...	16.4	14.8	13.6	12.5	11.6	11.0	10.3	10.0	C. P.
Zinc Sulphate	16.1	14.3	13.2	12.1	11.3	10.6	10.0	9.8	C. P.
Sod. Bisulphite	16.8	14.7	13.6	12.4	11.4	10.6	10.0	9.7	Technical.
Formaldehyde	16.5	14.1	11.9	10.1	9.0	8.5	7.9	7.4	40%.
Copper Sulphate	16.0	13.8	12.8	10.6	9.3	8.2	7.5	7.1	Cryst. C. P.
Phenol	16.2	13.6	11.4	9.5	8.2	7.4	6.9	6.9	U. S. P.
Benzoic Acid	15.0	12.5	10.9	9.3	8.0	7.2	6.6	6.2	Synthetic.
Benzaldehyde	16.0	13.4	11.1	9.2	7.4	5.8	4.7	4.4	U. S. P.



The importance of ultra-violet radiations is being increasingly recognized. That they have a pronounced effect on vegetative organisms is indicated below and which further confirms results obtained (unpublished) by the writer on medicinal plants.

Twenty-six grams of sugar were dissolved in distilled water sufficient to make 250 cc. and 3 grams of compressed yeast added. Fifty cubic centimeter portions were exposed to the action of the ultra-violet radiation. The U. V. R. machine was of the disruptive spark type with iron terminals 3/16 of an inch apart; the spark was 6 inches above the surface of liquid, the latter being in constant agitation since any action which takes place in a cloudy liquid is confined largely to the surface.

Table No. 3.

	Exposed 16 Minutes	*Exposed 20 Minutes*
Original	20.0	20.0
1 hour after treatment	18.2	19.0
2 hours " "	16.7	18.5
3 " " "	15.8	18.0
4 " " "	15.3	17.5
5 " " "	14.7	17.3
6 " " "	14.2	17.0
7 " " "	14.2	16.9
8 " " "	14.2	16.8

Conclusions.

1. A method is described for measuring the retarding action of various anti-ferments on yeast-sucrose solutions. The data may be interpreted as a measure of the efficiency of the several materials commonly used for preventing fermentation.

2. While ultra-violet radiation is largely used at present as a bactericide it would seem that for certain purposes its use might be further extended as an anti-ferment, especially since no toxic residue is left in the treated material.

3. It is to be noted that in most cases the action of the anti-ferment is one of gradual retardation rather than immediate cessation of activity.

4. It is rather surprising to note that a number of commonly used materials have a low percentage of efficiency.

5. A later paper will discuss certain other interesting phases growing out of this study.

ABSTRACTED AND REPRINTED ARTICLES

"HIGH-BROW STUFF" AND THE PRESCRIPTION COUNTER.*

By Wilbur L. Scoville.

In recent months articles have appeared in at least three different pharmaceutical journals—and in one of the journals two different articles—on the subject of the hydrogen-ion concentration of solutions.

All of the writers were astute enough to suspect that this subject is of but little if any interest to the average pharmacist, and quasi-apologies therefore accompanied the papers. Also suggestions were advanced as to ways in which this subject might be made to appeal to the attention of the pharmacist. He was told that hydrogen-ion concentration is an important factor in the vitality of living cells, in the constancy of physiological fluids, in the activity of pathological organisms, in the functioning of disinfectants, in the activation of enzymes (including diastase, pepsin, and pancreatin), in the preservation of colloidal conditions, in vitamins (perhaps), in the stability of alkaloidal solutions, in the reactions of sensitive salts, in the fertilizing of soils, in the preservation of serums, and in—well, a lot of things.

But Mr. Pharmacist has preserved his cell vitality, and activated his peptic juices, and disinfected his cuts, and assimilated his vitamins for so many years without even knowing of the existence of hydrogen ions that the concentration of these ions doesn't bother him any. And he sees no use in bothering about them.

Getting Down to Earth.

Thus far nobody has had the temerity to suggest that this high-brow stuff might be dragged down to the prescription counter and made to function on a guileless mixture. Wherein the sapient writers referred to in the opening paragraph missed a point.

Here, then is my opportunity to sit among tne sagacious.

*Reprinted from the *Bulletin of Pharmacy*, October, 1922.

An Iowa druggist recently had the following innocent-appearing prescription presented to him for compounding:

Solution of potassium citrate	4 fluidounces
Citrated caffeine,	
Urotropin,	
Potassium acetate, of each	2 drachms
Peppermint water	2 fluidounces

Directions: A teaspoonful every three hours.

He made his solution of potassium citrate according to the U. S. P. formula, and in it dissolved the urotropin and potassium acetate. Then he dissolved the citrated caffeine in the peppermint water, added this to the first solution, and got a nice clear solution. Also some good money.

A Mass of Crystals.

A few hours later the bottle was brought back because the mixture was now a mass of crystals and could not be poured out uniformly. The druggist tried a different method of mixing and got the same result, a clear solution at first which later changed to an apparently solid mass of crystals. A third trial made no improvement in final results. Then the physician informed him that his competitor down the street had sent out a clear solution which remained clear, and why couldn't he do the same? Right here is where the concentration started; the "ions" were in the fire.

Now to pull them out.

This is a six-ounce mixture, containing forty-eight fluidrachms and four very soluble salts, namely: potassium citrate, about two and a half drachms, which is soluble in about a drachm and a half of water; potassium acetate, two drachms, which is soluble in about a drachm of water; urotropin two drachms, which is soluble in three drachms of water; and citrated caffeine (really a mixture of equal parts of caffeine and citric acid), two drachms, which, as the Pharmacopœia puts it, is soluble in "a small quantity of water"—let's say an ounce as a good measure.

Here then is about eight and a half drachms of solids which should be soluble, according to all calculations, in thirteen and a half drachms of water, but which refuses to stay in solution in forty-eight drachms! How come?

In the first place, urotropin, also known as hexamethylenamine,

is alkaline in reaction and neutralizes acids. Two drachms of urotropin requires just one drachm of citric acid for complete neutralization, which is just the amount that is present in two drachms of citrated caffeine. We therefore have, theoretically, one drachm of free caffeine, which should be soluble in about 46 drachms of water, and there are nearly 48 drachms of water present.

The expected reaction does not happen, however. For when urotropin is "neutralized" it is gradually decomposed with the liberation of formaldehyde and formation of ammonium citrate. Here's the equation:

$$\underset{\text{(urotropin)}}{3(CH_2)_6N_4} + \underset{\text{(citric acid)}}{4H_3C_6H_5O_7} + \underset{\text{(water}}{18H_2O} = \underset{\text{(formaldehyde)}}{18CH_2O} + \underset{\text{(ammonium citrate)}}{4(NH_4)_3C_6H_5O_7}$$

But formaldehyde has a very pungent odor, and there is no smell of formaldehyde in the mixture. The citric acid is present and the urotropin is in contact with it, yet they do not react. Wherefore?

Now according to the hydrogen-ion theory the hydrogen-ion concentration is the measure, not of the total quantity of an acid (or alkali) that is present in a solution but of the quantity that is dissociated and thus has free hydrogen ions present which can react with other bodies. For be it remembered, according to Arrhenius, acids and alkalies do not react *as such* but only the dissociated ions of the acid and alkali unite. Hence an acid which dissociates freely is a "strong" acid; it reacts energetically. An acid which does not dissociate freely is a "weak" acid; it reacts sluggishly.

Now citric acid is neither a strong acid nor a particularly weak one in its ionizing qualities. It tends to the weak side but is ordinarily quite active, as all pharmacists know. Yet here it does not appear to act at all.

A Theory Proved.

So again we consider. We now remember that potassium citrate and potassium acetate are excellent "buffer salts." They hinder acids or alkalies, particularly weak ones, from dissociating and therefore from reacting. That is to say, the urotropin has two protectors present—potassium citrate and potassium acetate—which prevent the citric acid from attacking it. So it remains calm and serene in the presence of its would-be destroyer. For the same reason the citric acid is unable to exert its solvent action on the caffeine, and the latter behaves as though it were not present.

These theories are proved by adding two or three drachms more of citric acid to the mixture in compounding. Then a sharp odor of formaldehyde is noted and only a few crystals of caffeine separate out on standing over night. The extra amount of acid partly overcomes the buffer action of the salts, the urotropin is partly decomposed, and most of the caffeine is held in solution.

However, since potassium citrate and potassium acetate are administered in part for their alkaline action on the system, it is not good pharmacy to change the therapeutic action in order to get a clear solution; neither is it good pharmacy to administer formaldehyde when urotropin is wanted.

On substituting hydrochloric acid for the citric in the citrated caffeine we obtain better results. Sixty grains of citric acid is equal to about seventy-eight minims of 34 per cent. hydrochloric acid in total acidity. But hydrochloric acid ionizes more freely in solution and acts as a "stronger" acid. It liberates more hydrogen ions.

By using 60 minims of hydrochloric acid in place of the 60 grains of citric acid in this prescription, the results are apparently the same. The buffer action of the salts is still manifested—probably liberating acetic and citric acids in place of the free hydrochloric acid. If the hydrochloric acid be doubled, the results appear to be slightly better than when citric acid is doubled. And when 240 minims of hydrochloric acid is used in comparison with 240 grains of citric acid, the former solution remains clear at temperatures above about 25° C., while the latter will crystallize. The hydrochloric solution contains about three-quarters as much of total acidity as the citric solution, but since hydrochloric acid is ionized in greater degree its effects are more marked, thus again showing the influence of hydrogen ions in this mixture.

Another proof that the buffer action is the key to the trouble is shown in that if the mixture be compounded as written, then heated on a steam bath for about half an hour, formaldehyde is given off and the mixture remains clear for a longer period. This means that the dissociation of the acid, or in other words the hydrogen-ion concentration, is greatly increased by heat while the buffer action of the salts is reduced. Heating the mixtures containing the extra amounts of citric acid has a similar effect; crystallization is hindered for some time. But in all cases some of the caffeine crystallizes out on long standing, unless a large excess of acid is used, and urotropin is lost if heat or extra acid is employed.

The Best Way Out.

The best way to administer a combination of this kind is to increase the volume of the mixture to the point where the caffeine will remain in solution and not be salted out. In this case make a twelve-ounce mixture in place of a six-ounce by adding six ounces more of peppermint water. Then the dose should be doubled. Also the doctor consulted.

Thus a clear solution would be dispensed with no decomposition of the urotropin and no change in the expected therapeutic effects.

President Lincoln, when a young man, used to say that he wanted to absorb all the knowledge possible. Some of it might not be of any use to him for many years, but it was pretty sure to be of real value some time. Then it would be well worth having.

THE WORLD'S SUPPLY OF IODINE IN RELATION TO THE PREVENTION OF GOITRE.*

Owing to the varying reports as to the concentration of iodine in sea water, I have made a number of determinations on water dipped from the Santa Monica, Cal., pier. Even after filtration, this water contained so much colloidal material as to interfere with the determinations. It was finally observed that thorough shaking with carbon tetrachloride and filtration removed this sufficiently to make analysis possible. The carbon tetrachloride was purified by the addition of a drop of bromine, action of sunlight and shaking with an excess of sodium thiosulfate solution. In determining this excess, some very dilute sodium carbonate solution was poured into the carbon tetrachloride and tenth normal sodium thiosulfate run in, about half a cc. at a time, followed by shaking, until the color disappeared. This solution was separated off and more carbonate and about two cc. of thiosulfate added with thoroughly shaking, followed by separation of the water phase. The carbon tetrachloride was then dried and distilled, the first distillate being rejected.

It was found that evaporation of the sea water until sodium chloride began to crystallize out made it acid, due to precipitation of calcium carbonate and the hydrolysis of $MgCl_2$, magnesium being a

*From the Southern Branch, University of California, and the University of Minnesota. (Reprinted from *Science*.)

weak base, but there was no loss of iodine. Furthermore, a dry salt could be made of the sea water, without appreciable loss of iodine. This was accomplished by evaporation until the calcium carbonate precipitated; precipitation of the remaining calcium and magnesium by the addition of 100 cc. of seven per cent. Na_2CO_3 solution for each liter of original volume; filtration; washing the precipitate on the filter and evaporation of the filtrates to dryness.

In the analysis of the iodine content of salt, it was dissolved in water and the same procedure followed as with brine. In analyzing water or brine, standard solutions of the same NaCl content but varying concentration of iodate were made up and treated in the same way as the unknown. The quantity of reagents added varied with the samples, and no portions were thrown away until the yield of iodine was found to be complete. Each sample if not near neutrality, was neutralized, using test paper, and about 10 cc. of concentrated HCl per liter added. In case buffers were present, at least enough acid was added to react acid to brom-phenol-blue (or methyl-orange). An excess of arsenious acid was added to reduce the iodate to iodide, the equivalent of 1 to 10 cc. of tenth normal per liter, and allowed to stand 20 minutes or more. At this stage colloids, if present, were removed. One per cent. sodium nitrite solution was added to the extent of ten times the quantity of arsenious acid. The sample was then extracted with several portions of carbon tetrachloride which were then collected in a separatory funnel. In cases of 0.04 milligram per 100 cc. of the sample, a pale pink color could be detected in the carbon tetrachloride. The smallest workable quantity, often 1 cc. of very dilute (less than 0.1 per cent.) sulfurous acid was shaken with the extract until complete extraction of the iodine was effected. The carbon tetrachloride was removed from the sulfurous acid solution and a drop of concentrated sulfuric acid added, followed by sufficient sodium nitrite solution to oxidize the sulfurous acid and completely oxidize the iodide to iodine. The iodine was extracted with a sufficient quantity of carbon tetrachloride to fill the colorimetric apparatus (which varied in nature with the size of the yield) and compared with the standards. There must be nearly the same quantity of iodine in the final standard taken for comparison as in the unknown, and the treatment must be identical, quantitatively, especially in regard to volume relations and thoroughness of shaking.

The quantity of iodine found in the sea water was 0.05 milli-

grams per liter, which is a confirmation of the findings of Winkler for Adriatic sea water. Winkler probably had less decaying organic matter in his samples than were present in mine, as he makes no mention of difficulty on account of the presence of colloid material.

A sample of water which I dipped up from the Saltair pier, in the Great Salt Lake, Utah, contained only 40 per cent. more iodine than in sea water although the chlorine concentration was about 500 per cent. greater than in sea water. Since the Great Salt Lake is the residue left from the evaporation of Lake Bonneville, which was 1,000 feet deeper than the Great Salt Lake, and received practically all of the drainage of the Great Basin, covering Utah and parts of neighboring states, we have here a demonstration of the small quantities of iodine that are given up in the weathering of both igneous and sedimentary rocks.

Practically all of the iodine of the earth's surface is in the sea, which contains about sixty billion metric tons of iodine in the form of inorganic salts. This iodine probably entered the sea at the time chlorine accumulated in it. Iodides were probably the most soluble salts on the earth's surface, chlorides being next in solubility. If the earth was once hot on the surface, it is probable that hydriodic acid existed in the atmosphere and was washed into the sea with the first rain. Insoluble iodides of heavy metals are considered by Emmons to be secondary formations, due to the seepage of sea water through ores.

Judging by the prevalence of goitre, there is often a deficiency of iodine in our food and drink. At present, so little is known about the exact quantities of iodine taken into our stomachs that we can judge only by the number of cases of goitre. Omitting the details of local distribution of goitre, there is a wide goitre belt extending north along the Appalachian mountains to Vermont, thence west through the Great Lakes region to Montana and Washington and turning south it finally includes all of the Rocky Mountain and Pacific states. In fact, the goiterous belt includes the mountainous and glaciated regions. Since the run-off from mountainous and glaciated regions has carried away so much of the soluble material, it seems likely for this reason in addition to other evidence that the goiter belt is a low iodide belt.

Since the goiter belt includes large cities and millions of population, it seems unlikely at present that all of its inhabitants will receive

iodide medication in pure form. Since the sea contains the bulk of the supply, the transfer of iodine from the sea to our food or drink should be increased. Perhaps the most attractive method is the inclusion of sea-foods in our diet, but this is limited. Dr. Turrentine, of the Kelp-Potash Plant at Summerland, Cal., informs me that powdered kelp, when added in small amount to food cannot be tasted and when added in larger amount imparts a pleasing taste to it. Since it is richer in iodine than ordinary sea-food and is relatively abundant, it should be an important source of iodine in our diet. Since sea water and salt deposits contain iodine, salt might be made an important source of iodine in our dietary scheme. Blood and shell fish are about the only foods that do not require the addition of salt to make them palatable and fill our physiological needs, and hence the presence of iodine in salt would insure its universal consumption. Mr. O. S. Rask and myself failed to find iodine in any one of a number of samples of salt examined. Salt could easily be prepared from sea water as described above with the retention of the iodine compounds and at a cost not exceeding that of present-day table salt. Some of the magnesium carbonate precipitated from it could be added later if it be desired to make a shaker-salt, but from a nutritive standpoint, the addition of calcium phosphate for this purpose is highly desirable.

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LAC MAGNESIÆ.*

By C. E. Corfield, B. Sc. (Lond.), F. I. C., Pharmaceutical Chemist.

The preparation of magnesium hydroxide mixture has for a considerable time been a source of trouble to the practising pharmacist. Published methods by which this mixture is obtained produce preparations which are quite unsatisfactory, because they are not of the consistency of a cream or emulsion. Such preparations under normal conditions show an appreciable separation of water. This question has been raised in connection with the revision of the British Pharmaceutical Codex, and in view of the success resulting from a systematic examination of the problem, it was thought desirable in the

*From the *Pharm. Jour. and Pharm.*

interests of British pharmacy to publish the main features of the work and the method of obtaining a satisfactory mixture.

By the method of the B. P. C. (1911, p. 1287), the mixture is prepared by precipitating and washing magnesium hydroxide, incorporating with this precipitate one-third of its weight of hydrate in the form of light magnesium oxide and mixing with water to give a product containing the equivalent of about 24 grains of magnesium hydrate ($Mg(OH)_2$) per fluid ounce. The addition of magnesia was made probably to give the mixture a less translucent appearance than that associated with mixtures prepared entirely with precipitated hydrate. Nevertheless the product is too translucent and deposits readily. The experiences of other investigators show that alternative methods as published give results equally unsatisfactory. Moreover, a stronger mixture is usually required, and the aim of this investigation has been to produce a mixture containing the equivalent of about 36 grains of magnesium hydrate per fluid ounce.

Magnesium hydroxide, or hydrated oxide, $Mg(OH)_2$, is prepared by mixing solutions of a soluble magnesium salt, such as magnesium sulphate, and a soluble hydroxide, such as sodium hydroxide. It appears as a gelatinous precipitate which, after washing and drying, forms a white amorphous powder. In the presence of water it forms an alkaline mixture which is not caustic, and it is therefore suitable for internal use.

In the experiments described below the hydroxide used was obtained by the interaction of magnesium sulphate, and sodium hydroxide using a slight excess of magnesium salt. A series of tests showed that by interaction at different dilutions the product was always translucent, and, after washing and adjusting by the addition of water to the required strength, it was of the consistency of a jelly. By triturating this jelly with dry hydrated oxide or light magnesia it was shown that a fluid mixture containing the equivalent of 36 grains per fluid ounce could be obtained, and that one part by weight of precipitated hydroxide was capable of suspending one and a half times its weight of added substance. Although such mixtures deposit very slowly, they are less opaque than is desirable. Further experiment showed that precipitated hydroxide was capable of suspending a much larger proportion if incorporated with the sodium hydroxide solution before interaction with the solution of magnesium sulphate. The best results were obtained by taking sufficient magnesium sul-

phate and sodium hydroxide to give one part of magnesium hydroxide, dissolving each in separate portions of water, thoroughly triturating the solution of sodium hydroxide with seven parts of magnesium hydroxide added as light magnesia and after dilution with water, adding this to the solution of magnesium sulphate. The operation of rubbing down the light oxide with the caustic alkali facilitates a creamy product due in all probability to partial hydration of the oxide, whilst the small particles of this material remain suspended in the final product as the result of a film of gelatinous hydrate formed in the subsequent reaction with the magnesium sulphate.

Details with regard to quantities of material and method of preparation are as follows:

Crystalline magnesium sulphate	37.5 gms.
Anhydrous sodium hydroxide	12.0 gms.
Light magnesium oxide	42.0 gms.
Water	a sufficient quantity
Distilled water	to 800 cc.

Dissolve the sodium hydroxide in 100 cc. of water, triturate thoroughly to a smooth cream with the light magnesium oxide and dilute with water to produce 2,000 cc.; pour the suspension in a thin stream into 2,000 cc. of water, containing the dissolved magnesium sulphate and stir constantly during the mixing. Set aside for twenty-four hours, syphon off the clear liquid, transfer the residue to a calico strainer, allow to drain, wash with distilled water until the washings are free from saline taste, and mix the residue with sufficient distilled water to produce the required volume.

Although the consistency of the product leaves but little to be desired, it can be varied without alteration of strength by an adjustment of the amount of light magnesia used, and a corresponding adjustment of the final volume. Every six gms. of oxide is equivalent to 100 cc. of mixture containing 36 grains of $Mg(OH)_2$ per fluid ounce. Consequently a thicker product can be obtained by incorporating 36 gms. of oxide and making the final volume up to 700 cc., whilst for a more mobile preparation 48 gms. of oxide can be added, and the final volume made up to 900 cc.

The author makes no claim that this is the only method by which a satisfactory magnesium hydroxide mixture can be prepared, and invites suggestions based upon experience that may add to the improvement of the process.

SOLID EXTRACTS

Germany now wants its African Colonies back and in exchange offers the chemical child of a chunk of coal. Bayer's 205 is the synthetic, heralded as a cure for the dreaded African sleeping sickness, the curse of the fertile Congo territory. This new discovery (it is alleged) will open the door of the richest part of Africa to the enterprising colonist by eradicating the disease that has heretofore made colonizing an impossible task.

The Brontosaurus, the largest of all the prehistoric lizards, grew to be sixty feet long and fourteen feet high.

Pasteur, the great French bacteriologist, whose centennial is to be celebrated in December, spent five years studying the diseases of the silkworm for the Department of Agriculture of France.

Sulphur fumes can be used in bleaching cherries, gelatine, fruits, syrups, nuts, potatoes and cereals, by a patent process in which hydrogen peroxide is added to remove all traces of sulphur dioxide which would otherwise be left in the food.

Rhazes, Persian physician of the tenth century, picked out the site for a hospital in Bagdad by hanging pieces of meat in different parts of the city in order to find the place least favorable to putrefaction.

Magnificent orchids and rhododendrons and gigantic blueberries can be grown in ordinary soil to which aluminum sulphate is added, Dr. Frederick V. Coville, chief botanist of the U. S. Department of Agriculture, has discovered. Such rare plants will not flourish in untreated soil that is alkaline.

A grain of musk will scent a room for several years, yet not lose one-millionth of its mass in a year. This is true of the synthetic as well as the natural product.

It may soon be possible to spray your throat and so become immune to pneumonia infection. Dr. Russell L. Cecil and Gustav I. Steffen, of the Hygienic Laboratory of the U. S. Public Health Service, working at Bellevue Hospital in New York have completed experiments on monkeys that suggest that considerable immunity against virulent pneumonia can be obtained by the mere spraying of the throat with a very strong suspension of killed pneumonia germs.

In 1920 pneumonia was responsible for 137.3 deaths out of every 100,000 people in the United States, and in fatality it was outranked only by tuberculosis and organic heart disease. In 1918, when influenza deaths mounted to the high total of 300.8 per 100,000, pneumonia as a frequent after effect caused a pneumonia death rate in that year of 286.2.

Dr. Simon Flexner, of the Rockefeller Institute for Medical Research, has discovered that the clear contents of cold sores on lips and nose of sufferers from encephalitis (American sleeping sickness) will not only produce similar eruptions when inoculated in rabbits, but that a proportion of such inoculated rabbits develop the nervous effects and symptoms of the disease.

Rocky Mountain spotted fever, a highly fatal malady, is transmitted to human beings through the bite of a wood tick infesting the woods and pastures in parts of Montana, Wyoming and Idaho. The disease reaches in certain places and at certain times a mortality of 70 to 80 per cent. Farmers, herdsmen, lumbermen and sportsmen are thus especially attacked.

A serum for combating this highly fatal malady, has been produced in the laboratories of the Rockefeller Institute for Medical Research.

Pneumonia, due to the pneumococcus, alone or allied with the Friedlander bacillus is now classed into three specific types with a fourth group to care for the non-specific cases. A valuable serum has been devised for the treatment of sufferers with the Type I infection. Serums for the treatment of the other types are not successful, although the newest plan is to use a solution of polyvalent pneumococcic antibodies separated by chemicals from the organisms and injected into the veins of the patient. This is still an experiment.

SCIENTIFIC AND TECHNICAL ABSTRACTS

Pyramidon Test for Blood.—Fortwaengler (*British Medical Journal Epitome*, I, 1922, 92) confirms the discovery of Thévenon and Rolland that pyramidon is a much more delicate test for blood than either guaiacum or benzidine. The solutions required for the test are: (1) Pyramidon 5, alcohol (90 per cent.) 100. (2) Glacial acetic acid 25, distilled water to 50. (3) Hydrogen peroxide (Merck) 3 per cent. The original method was as follows: To 2 to 3 cc. of the fluid to be examined were added 6 to 8 drops of the acetic acid solution, 2 cc. of pyramidon solution, and 6 to 8 drops of 3 per cent. hydrogen peroxide. The mixture was well shaken and allowed to stand. The appearance of a lilac color is positive for blood. Fortwaengler has increased the acetic acid solution to 16 drops and the peroxide solution to 12 drops, and claims that this gives a more rapid

and distinct coloration. He also recommends that after shaking up the suspected fluid with the acetic acid solution and allowing the mixture to stand for a time, the test tube should be inclined and the hydrogen peroxide solution gently poured on the surface of the mixture; if blood be present a "lilac cloud" will appear very suddenly; if this is absent at the end of two minutes the specimen contains no blood.

FIRE-RETARDING CHEMICAL FOR WOOD.—Factors influencing choice of such a chemical are: Salt must not attract water too much or the wood will always be damp. It must not affect tools of workman and also any metal fittings applied to the wood. It should not be poisonous in case a splinter should enter a person's hand. It should be fairly effective at low concentrations. It should not be volatile at ordinary temperatures nor soluble if used for outside work. It should penetrate easily. It should not affect the strength of the wood nor affect any decorative coating applied over the wood. Thus, it seems that the search for practical retardent chemical is beset with great difficulties, for those salts that are readily obtainable fail in one or more of these seven conditions. Chemicals tested fall into three classes. The fire promoters are cupric chloride, bismuth chloride, ferric chloride, alum, barium sulfate and stannic chloride. Those that have little effect on the wood are ammonium chloride, sodium chloride, boracic acid, and aluminum sulfate. Those that have a fire-retarding effect are zinc chloride, mixture of phosphate and borax, magnesium chloride, calcium chloride, ammonium sulfate, ammonium phosphate, borax, sodium silicate, and zinc ammonium phosphate. Ammonium phosphate was best of all tested, since it gives off an incombustible gas, ammonia, leaving orthophosphoric acid that melts and covers fibers of wood.—(W. O. Banfield and W. S. Peck, *Canadian Chem. and Met.*, 8-22, 3000 w. CJW.) Through *Industrial Digest*.

MUSCARINE, ISOLATION OF ——, THE POTENT PRINCIPLE OF AMANITA MUSCARIA.—About 0.12 g. of pure muscarine aurichloride was isolated from 25.5 kg. of fresh *A. muscaria* after a long and tedious process which consisted essentially of several precipitations of the clarified alcoholic extract first with aqueous, and then with alco-

holic mercuric chloride, and finally with phosphotungstic acid. The precipitated bases consisted chiefly of choline and muscarine in the proportion of about 20 to 1, and the former was largely removed by fractionation of the *d*-hydrogen tartrates. Fractionation was continued by means of the aurichlorides, and finally large delicate leaflets of pure muscarine aurichloride were isolated. The whole operation was controlled physiologically by following the distribution of activity by observations of the effects produced on an isolated loop of rabbit's intestine. Pure muscarine chloride was found to be about seven times as active as arecoline, and five times as active as acetylcholine. Physiological assay assigns a content of 0.4 g. of muscarine chloride to the extract from 25.5 kg. of fresh fungus. Muscarine chloride has a molecular weight of about 210; it is quite stable towards alkali and cannot therefore be an ester of choline, nor is there any evidence for the accepted formula with one oxygen atom more than choline, or that it is a quaternary base. It appears to be an alkaloidal base of considerable complexity.—G. F. M. (H. King. *Chem. Soc. Trans.*, 1922, 121, 1743-1753.) Through *Journ. of Chem. Ind.*

CLASSIFICATION OF THE MORE IMPORTANT INDUSTRIAL CATALYTIC REACTIONS

Type of Catalyst	*Samples of Exemplification in Industrial Practice*
	Hydration and Hydrolysis
Acids	(a) Hydrolysis of glycerides, soap and candle industry, sulphuric, sulphonic (Twitchell reagent) acids as catalysts.
	(b) Hydrolysis of starches and wood cellulose to yield sugars. Sulphuric, hydrochloric, sulphurous acids as catalysts.
	(c) Hydrolysis of esters using acids.
	(d) Hydration of acetylene to yield acetaldehyde. Various acids as catalysts.
Alkalies	(a) Hydrolysis as in (a) and (c) above. NaOH, KOH, $Ca(OH)_2$, MgO, ZnO as catalysts.
	Dehydration
Acids	(a) Manufacture of ether. Sulphuric, sulphonic and phosphoric acids as catalysts.
	(b) Esterification processes. Hydrochloric and sulphuric acids as catalysts.
Oxides	(a) Manufacture of ethylene and unsaturated hydrocarbons. Clays, Al_2O_3, SiO_2, TiO_2 as catalysts.
	Halogenation
Non-metallic elements	(a) Chlorination of carbon disulphide, carbon-monoxide and hydrocarbons. Carbons, iodine, sulphur as contact agents.
Chlorides	(a) In synthetic organic, chemistry. $AlCl_3$, $FeCl_3$, $SbCl_5$, $SnCl_4$, $ZnCl_2$, $HgCl_2$, as contact agents.
	Oxidation
Metals, especially the platinum metals	(a) Contact sulphuric acid process using finely divided platinum on a suitable support.
	(b) The oxidation of ammonia using a platinum gauze.
	(c) The preparation of formaldehyde, using copper or silver (see dehydrogenation).
Oxides	(a) Lead chamber process, employing a gaseous catalyst, oxides of nitrogen.
	(b) Contact sulphuric acid manufacture with iron oxide catalyst.
	(c) Chance-Clause process of sulphur recovery. Oxide of iron as catalyst.
	(d) Purification of illuminating gas. Hydrated oxide of iron as catalyst.
	(e) Surface combustion processes, refractory oxides as catalysts.
	(f) Oxidation of hydrocarbons, V_2O_5, MoO_3, WO_3, etc., as catalysts.
Salts	(a) Deacon chlorine process, copper chloride as catalysts.
	(b) Oxidation processes in the dye industry. Mercury and copper salts.
	(c) Oxidation of aldehydes, manganese salts as catalysts.
	(d) Drying of oils. Metallic soaps as accelerators.
	Hydrogenation
Metals	(a) Hydrogenation of oils. Nickel and platinum as contact agents.
	(b) Fine organic chemical industry, e. g., synthesis of cyclo-hexane, reduction of organic compounds. Nickel as catalyst.
Oxides	(a) Hydrogenation of oils, nickel oxide as catalyst (especially at elevated pressures).
	Dehydrogenation
Metals	(a) Cracking of oils, nickel, copper, iron, aluminum as catalysts.
	(b) Dehydrogenation of alcohols, copper, silver and nickel as catalysts.
Oxides	(a) Cracking of oils, Al_2O_3, and TiO_2 as catalysts.
	(b) Dehydrogenation of alcohols, ZnO, SnO, CaO and MgO as catalysts.
	Nitrogen Fixation
Metals and metal-oxide mixtures	(a) Ammonia synthesis. Reduced iron, iron-molybdenum, iron-potash, and nickel-sodium as contact agents.
	(b) Cyanide formation. Reduced iron as catalyst.
	(c) Arc process of oxide of nitrogen formation. Metal electrodes as negative catalysts.
	(d) Nitride formation (Serpek process). Iron, copper, chromium, molybdenum, etc., as catalysts.

Chemical Age.

REVIEW OF CURRENT FRENCH LITERATURE.

By William H. Gano.

Preparation of Samples for Analysis.—Sufficient importance is not accorded this operation; it is as important, nearly, as the analysis itself. The writer is opposed to the use of sieves—one separates in this way parts having different physical properties, and their ultimate normal mixture is problematical—the prolonged and repeated return-sievings do not suffice in certain cases. Mixing in a mortar is not always efficacious. The reduction of a bulky sample to one of less volume is delicate, and can only be correctly done by the repeated division of the material put into a square and divided by diagonals—taking each time the opposite triangles. It is necessary to distrust mixing machines—certain of them, by their principles of constructon, separate materials in the order of density.—From *Chem. Ztg.*, through *Annales de Chemie Analytique.*

Formation of Precipitates From Friction of Glass.—When one rubs the sides of a glass vessel with an agitator fine particles of glass can always be obtained, which have an influence in the determination of a crystallization or a coagulation. By prolonged friction one can always produce a precipitate—even in distilled water—and beginners must be on their guard.—From *Zeits. Electrochem* through *Annales de Chemie Analytique.*

On the Inflammability of Benzin, etc.—The spontaneous ignition of *anhydrous* and inflammable liquids often takes place during the decanting, or filtering of these liquids in a glass funnel, whatever may be the nature of the receptacle from which the liquid is poured—though from glass to glass is the more dangerous.

I have noticed, in a dull light, sparks under these circumstances—but insufficient to produce flame. For a long time I have forbidden the use of glass receptacles or glass funnels in the manipulation of these liquids.—A. Brun in *Journal Suisse de Pharmacie.*

Creasote in Dental Treatment.—The analgesic and mildly caustic properties of creasote cause it to be chosen in the treatment of pulps and dental neuralgias. The reputation laid to creasote of causing the teeth to break or crack is absurd. The decayed tooth breaks, not because it has been in contact with creasote, but simply because it

has been neglected in regard to filling. Coal-tar creasote, being more caustic, calms quicker than that from Beechwood—but the latter should be always used in dental treatment.

Creasote can be used pure or mixed with other remedies in the treatment of dental fistulas, pulps, or after extraction. An excellent formula is the following:

Beechwood Creasote	4 gm.
Alcohol (95%)	2
Guaiacol	2
Formol (40%)	1.50
Ess. of Rose Geranium	0.50

This formula has the advantage of slightly masking the odor of the creasote.—From *Journal des Prateciens,* through *Bull. des Sci. Pharmacologiques.*

Increase of Specific Activity of Metals by Addition of Lipoids.—In the matter of tin, mercury, or the salts of didymium the addition of lipoids presents four advantages in the opinion of Dr. Mollin in *Journal de Médecine et Chirurgie Pratique:*

First. It enables us to obtain, in infinitesimal doses, results equal or superior to those obtained from the natural metal given in the usual doses.

Second. The extreme dilution of the metal excludes all possibiliies of intolerance; it seems that with equal quantities the metal in lipoidal association is less toxic than when natural.

Third. This extreme dilution has moreover the advantage of permitting hypodermic use.

Fourth. Administered intravenously, the lipoidal metal provokes no phenomenon of shock.—From *Répertoire de Pharmacie.*

Casein Cement.—After many trials undertaken by the English Bureau of Aeronautics the following formula for cement has been approved as best for retaining its adhesive properties:

Casein	78.
Sodium Carbonate (dried)	4.5
Sodium Fluoride	4.
Quick-lime (freshly slaked)	12.5
Sodium Arsenate	1.

Mix all together and pass through a sieve of twenty meshes. The preparation is used either with water or a weak solution of gelatin.—*Pharmaceutical Journal.*

Care Required in Handling Chrysophanic Acid.—The following note has lately appeared in *Le Bulletin de la Société de Pharmacie de Bordeaux.*—A pharmacist in preparing an ointment of vaseline and Chrysophanic Acid received some dust from this acid in his eyes. In about two hours itching ensued, followed by severe pain and intense conjunctivitis, with confused vision caused by clouding of the cornea. Relief was obtained from fomentations of infusion of elder blossoms with sodium biborate and laudanum added. For two weeks intense suppuration occurred. After eighteen days the vision improved somewhat, but at the end of six weeks had not recovered its former acuity and reading was very difficult.—From *Répertoire de Pharmacie.*

Elimination Through the Urine of Small Doses of Sodium Salicylate.—In his own name and in the names of MM. Fiessinger and Debray, M. Herissy has communicated to La Société de Pharmacie de Paris the results of researches which they have undertaken to determine the smallest possible quantity of Sodium Salicylate which a man can ingest in order to detect this substance in the urine. In following out their experiments they have detected this salt in the urine of persons who have only swallowed two milligrammes.—From *Répertoire de Pharmacie.*

Radioactive Elements as Indicators in Chemical Research.—Certain radioactive elements which are isotopic with a stable element can be employed with advantage as indicators. They can, when mingled, augment considerably the possibility of determining the element in question. In practical chemical analysis the radioactive elements prove of great utility in determining the solubility of salts difficultly soluble (lead chromate, for example) and for explaining or studying certain phenomena in the reactions of precipitation.—from *Chem. Ztg.*, through *Annales de Chemie Analytique.*

Butyl-ethyl-malonylurea—a New Hypnotic.—M. Tiffenau has presented to La Société de Pharmacie de Paris some researches made by him, concerning several hypnotics of the barbituric acid series, pointing out the above as being more active and acting more rapidly

than veronal. With man, the medicament in question acts as a hypnotic and as a sedative to the nervous system, the activity being about three times greater than veronal.—Abstract from *Répertoire de Pharmacie.*

Myrrh, Olibanum and Gum Arabic.—According to an American Consular report, the three principal gums produced in the basin of the Red Sea are, in the order of their importance, Myrrh, coming from Abyssinia and the interior of Arabia; Gum Arabic from Somaliland and Mokalla; and Olibanum, from British Somaliland, the Yemen and the Isle of Socotra. The Abyssinian Myrrh is considered the best. With the exception of the gums from the interior of Arabia, nearly all the collectors are Somalis, who carry their merchandise in a crude state to Aden, where it is sold to the merchants, who sort and prepare it for exportation.

Ellagic Acid in Raspberries.—M. Kunz-Krause (*Archiv der Pharmacie*) has observed in some syrup of raspberries prepared with the greatest care, a short time after its preparation, the production of a precipitate formed of small, brilliant, prismatic crystals, impregnated with a red coloring matter—insoluble in water and the ordinary solvents. Those crystals have been identified as ellagic acid.—From *Répertoire de Pharmacie.*

Pharmaceutical Antiquities.—L'institut de Pharmacie de Université de Lausanne has acquired the Reber collection of pharmaceutical antiquities. This collection will be placed and inaugurated next year on the occasion of the fiftieth anniversary of the founding of the university.—*Journal Suisse de Pharmacie.*

MEDICAL AND PHARMACEUTICAL NOTES

Bureau of Chemistry to Eliminate Adulterated Marjoram From Interstate and Foreign Commerce.—Steps to eliminate excessive foreign and objectionable leaves from marjoram are being taken by officials of the Bureau of Chemistry, United States Department of Agriculture, which is charged with the enforcement of the Federal Food and Drugs Act.

A recent investigation by the Bureau of Chemistry shows that marjoram from foreign sources frequently contains Cistus leaves. The presence of any appreciable amounts of Cistus or other leaves constitutes an adulteration of marjoram when shipped within the jurisdiction of the Federal Food and Drugs Act. In some instances marjoram was found to contain 25 per cent. or more of Cistus leaves.

The presence of Cistus leaves may be recognized by the blackish brown color which is developed when these leaves are soaked in concentrated ammonia. Coriaria, previously found present, and Althea under these conditions give a light brown color while marjoram remains light green.

Caution on the part of the importer would assist in discouraging and eliminating this form of adulteration. The dealer who ships adulterated marjoram into interstate commerce is responsible under the Federal Food and Drugs Act and should take steps, officials say, to correct this condition in order to free himself from liability to prosecution. Inspectors have been directed to give special attention to shipments of marjoram. Appropriate action under the Federal Food and Drugs Act will be taken in all cases found to be in violation of the law.

Carbon Tetra-Chloride as an Anthelmintic.—A review of the work done by various men is presented by G. C. Lake (*U. S. Public Health Reports,* May 12, 1922) as well as an extended report of his experiments which were carried on with several monkeys as the subjects. Experiments carried on by M. C. Hall (*Jour. A. M. A.,* 77, 21) indicate that the drug is not toxic to dogs when given in as large a dose as 1.5 cc. per kilo body weight. He found that 0.3 cc. per kilo of body weight was the effective dose and considered that carbon tetra-chloride was the most effective drug therapeutically and the least toxic of any of the vermifuges not excluding thymol and chenopodium.

It being apparent that repeated doses might be advisable, Lake took a number of monkeys as subjects and administered definite quantities of the drug to them over a period of one month. Doses varied in quantity from 1 cc. for monkey number one to 5 cc. for monkey number five. No apparent ill effects of the drug were noticed in any

of the subjects nor was intoxication evident. The drug was administered by stomach tube on an empty stomach.

As an anthelmintic for man a dose of 3 cc. is suggested to be given in hard gelatin capsules on an empty stomach. No cathartic should be given either before or after administering the drug as the carbon tetra-chloride induces active peristalsis. Breaking of the capsules in the mouth should be avoided as the entrance of the drug into the trachea might cause serious results.—J. W. E. H.

USE OF QUININE INTRAVENOUSLY IN THE TREATMENT OF MALARIA.—Kenneth F. Maxey cautions against the unrestricted use of Quinine intravenously in the treatment of any form of malaria. Particular note is taken of the danger accompanying the administration of solutions of the usual concentration of 7½ grains of the double salt of quinine and urea hydrochloride per cc. When 2 cc. of the above solution is introduced intravenously employing the usual hospital or private practice technique a marked quickening of the pulse is noted as well as a fall in both the systolic and diastolic pressures. Distressing nervous symptoms were also produced as well as sloughing of the tissues when small amounts of the solution were injected into the tissues accidentally.

Intravenous injection of quinine rapidly destroyed the asexual form of the parasites, however, the same results are obtained by oral administration, though somewhat longer time is needed. Whether quinine has any effect on the sexual form is still questioned no matter how it is introduced into the system.

Intravenous injection should only be resorted to when it is impossible to give the drug orally or where immediate cinchonization is indicated. In such cases the drug should be given well diluted, preferably ½ grain of the di-hydrochloride per cc. and in doses of 15 grains. The solution should be introduced under strict asepsis and injected into the blood stream slowly.—*U. S. Public Health Reports,* May 12, 1922.) J. W. E. H.

NEWS ITEMS AND PERSONAL NOTES

American Pharmaceutical Association, Committee on Research, Award of 1922-1923 Research Grants.—At the Cleveland meeting of the American Pharmaceutical Association the following grants were made from the A. Ph. A. Research Fund.

To D. I. Macht, Baltimore, Md., for pharmacological work on benzyl compounds	$200.00
To Albert Schneider, Portland, Oregon, for chemical and pharmacological work on Chaparro Amargosa and on Sodium Cinnamate	200.00

BOOK REVIEWS

Eclectic Materia Medica, Pharmacology and Therapeutics. By Harvey Wickes Felter, M.D., Professor of Materia Medica in the Eclectic Medical College, Editor *Eclectic Medical Journal.* Royal Octavo, 743 pp. illustrated. Cloth, $8.00. John K. Scudder, Publisher, 630 W. Sixth Street, Cincinnati, Ohio.

This is an unique volume, described by its author as an answer to the request of his pupils for a collection of his readings. So that an insight may be had to the expansiveness of the fields treated in the book, the table of contents is printed herewith.

Part I.

Introduction.

II. The Parts, Constituents, and Derivatives of Plant Drugs.
Parts of Plants Employed as Medicines, or in Their Preparation, Derivatives of Plant Drugs, Proximate and Other Principles of Plant Drugs.

III. Pharmaceutical Forms and Classes of Medicines.

IV. Action and Effects of Medicines.
General Nature of Drug Action, Effects of Drug Action, Selective Drug Affinity, Absorbability of Medicines, Administration and Rate of Absorption and Elimination, Circumstances Modifying Drug Effects, Cumulative Action, Drug Tolerance, Idiosyncrasy, Synergists and Antagonists, Dosage, Dosage of Specific Medicines, Salt Action.

V. Application and Administration of Medicines.

VI. Incompatibility.

VII. Management of Acute Poisoning.

VIII. Dispensing of Medicines.

IX. Specific Medication.

X. Classification of Specific Medication.

XI. Prescription Writing.
The Prescription, Medical Latin, Rules and Groups of Terminations, Construction of the Prescription, Illustrative Prescriptions.

XII. Weights and Measures.

XIII. Percentage Solutions and Dispensing Tables.

XIV. Definitions of Therapeutic Terms.

XV. Abbreviations, Words and Phrases.

XVI. Pharmaceutical Preparations With Doses (Other Than Specific Medicines).

XVII. Therapeutic Classification of Drugs.

XVIII. Sources of Drug Knowledge.

Part II.

Individual Drugs.

The new school of medicine that issues a vest-pocket pharmacopœia printed in 24-point Caslon type, will gaze with wonderment and benign sympathy at a publication as comprehensive and ponderous as

the volume reviewed. But this is no ordinary pharmacopœia. It is a marvellous hybrid of the dispensatories, pharmacopœia, textbooks on pharmacognosy, botany, chemistry and a host of other sciences; illustrated profusely and well it adds a pleasant moistness to otherwise arid reading—arid in so far as it dwell over-lengthily and without a rational basis upon the specific indications and therapy of its drug subjects. For instance, to gelsemium it dedicates fully five pages of intimate consideration. For iodine, a far more important drug, two pages are deemed essential. Asepsin a proprietary drug, little-known and less-used, is accorded more space than aspidium. Numerous such instances may be quoted. The author frankly acknowledges these peculiarities in his book, but the book nevertheless suffers from such treatment.

There are omissions of newer remedies which might be termed unfortunate; silver arsphenamine and scarlet red, for instance. Also a number of errors have crept into the text, particularly so in the chemical formulas recorded. On the whole, however, the volume is well arranged, well printed and well bound. It commends itself best, of course, to the eclectic physician and pharmacist, but contains much material, not found elsewhere, of exceeding interest and information to all students of medicine and pharmacy.

I. G.

National Cleaner and Dyer Book of Technical Notes. Revised and arranged by Roy Denney, Editor. 232 pp. Cloth $2. Dovost Bros. Co., Chicago, 1922.

The contents of this book comprises the Technical Notes and Question Box matter, together with other valuable information, compiled from the columns of the *National Cleaner and Dyer,* a monthly trade journal published since 1910. No attempt has been made to arrange and classify the subject matter except under the several general headings. The reader is advised to depend on the index and to consult it freely for locating the subjects and information desired. The information contained in the book will be helpful in solving many of the problems met by cleaners and dyers in the everyday work. The book is also very useful to the retail pharmacist who is consulted daily by his customers on topics of this sort. Editor Denney presents

much valuable information which can be readily turned into dollars and cents. On page 86, for instance, we find the new and excellent suggestion that formic acid is an effective agent for removing most all ink stains and also indelible pencil stains without affecting fast colors and without injurious action on fabrics of silk, wool or cotton. This information alone is worth the price of the book, which, therefore, we can highly recommend to druggists in general.

OTTO RAUBENHEIMER, Ph. M.

INDEX TO VOLUME 94 OF THE AMERICAN JOURNAL OF PHARMACY.

AUTHORS.

SUBJECTS.

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